

LIBER II

I. MUNDUM et hoc—quocumque¹ nomine alio caelum appellare libuit cuius circumflexu teguntur² cuncta, numen esse credi par est, aeternum, inmensum, neque genitum neque interiturum umquam. huius extera indagare nec interest hominum nec² capit humanae coniectura mentis. sacer est, aeternus, inmensus, totus in toto, immo vero ipse totum, finitus et infinito similis, omnium rerum certus et similis incerto, extra intra cuncta complexus in se, idemque rerum naturae opus et rerum ipsa natura.

3 Furor est mensuram eius animo quosdam agitasse atque prodere ausos, alios rursus occasione hinc sumpta aut ab³ his data innumerabiles tradidisse mundos, ut totidem rerum naturas credi oporteret, aut, si una omnes incubaret, totidem tamen soles totidemque lunas et cetera ut iam in uno et inmensa et innumerabilia sidera, quasi non eadem quaestione

¹ *Rackham*: quodcumque aut quod *codd.*

² *v.l.* degunt ('go on').

³ ab *add. Rackham.*

^a The Pythagorean and Stoic creed.

^b A variant gives 'infinite and resembling the finite.'

BOOK II

I. THE world and this—whatever other name *The world—
its nature.* men have chosen to designate the sky whose vaulted roof encircles the universe, is fitly believed to be a deity,^a eternal, immeasurable, a being that never began to exist and never will perish. What is outside it does not concern men to explore and is not within the grasp of the human mind to guess. It is sacred, eternal, immeasurable, wholly within the whole, nay rather itself the whole, finite and resembling the infinite,^b certain of all things and resembling the uncertain, holding in its embrace all things that are without and within, at once the work of nature and nature herself.

That certain persons have studied, and have dared *its size.* to publish, its dimensions, is mere madness; and again that others,^c taking or receiving occasion from the former, have taught the existence of a countless number of worlds, involving the belief in as many systems of nature, or, if a single nature embraces all the worlds, nevertheless the same number of suns, moons and other unmeasurable and innumerable heavenly bodies, as already in a single world; just as if owing to our craving for some End the same problem would not always encounter us at

^c The founders of the atomic theory, Leucippus and Democritus.

semper in termino cogitationis occursura desiderio finis alicuius aut, si haec infinitas naturae omnium artificii possit adsignari, non idem illud in uno facilius sit intellegi, tanto praesertim opere. furor est, profecto furor, egredi ex eo et, tamquam interna eius cuncta plane iam nota sint, ita scrutari externa, quasi vero mensuram ullius rei possit agere qui sui nesciat, aut mens¹ hominis² possit³ videre quae mundus ipse non capiat.

6 II. Formam eius in speciem orbis absoluti globatam esse nomen in primis et consensus in eo mortalium orbem appellantium, sed et argumenta rerum docent, non solum quia talis figura omnibus sui partibus vergit in sese ac sibi ipsa toleranda est seque includit et continet nullarum egens compagium nec finem aut initium ullis sui partibus sentiens, nec quia ad motum, quo subinde⁴ verti mox adparebit, talis aptissima est, sed oculorum quoque probatione, quod convexus mediusque quacumque cernatur, cum id accidere in alia non possit figura.

6 III. Hanc ergo formam eius aeterno et inrequieto ambitu, inenarrabili celeritate, viginti quattuor horarum spatio circumagi solis exortus et occasus

¹ mens *edd.*: meror, miror (haut minor *Deilefsen*).

² *v.l.* homines.

³ possit *om. nonnulli*.

⁴ sublime *Deilefsen*, rotunde *Mayhoff*.

^a Cf. Martial V. 39. 5 Aut semel fac illud | mentitur tua quod subinde tussis.

^b *Convexus* is used to denote the inside as well as the outside of a curve.

the termination of this process of thought, or as if, assuming it possible to attribute this infinity of nature to the artificer of the universe, that same property would not be easier to understand in a single world, especially one that is so vast a structure. It is madness, downright madness, to go out of that world, and to investigate what lies outside it just as if the whole of what is within it were already clearly known; as though, forsooth, the measure of anything could be taken by him that knows not the measure of himself, or as if the mind of man could see things that the world itself does not contain.

II. Its shape has the rounded appearance of a perfect sphere. This is shown first of all by the name of 'orb' which is bestowed upon it by the general consent of mankind. It is also shown by the evidence of the facts: not only does such a figure in all its parts converge upon itself; not only must it sustain itself, enclosing and holding itself together without the need of any fastenings, and without experiencing an end or a beginning at any part of itself; not only is that shape the one best fitted for the motion with which, as will shortly appear, it must repeatedly^a revolve, but our eyesight also confirms this belief, because the firmament presents the aspect of a concave^b hemisphere equidistant^c in every direction, which would be impossible in the case of any other figure.

III. The world thus shaped then is not at rest but eternally revolves with indescribable velocity, each revolution occupying the space of 24 hours: the rising and setting of the sun have left this not

^a *Medius* properly denotes the position of the observer at the centre, and is transferred to the circumference observed.

haut dubium reliquere. an sit inmensus et ideo sensum aurium excedens tantae molis rotatae vertigine adsidua sonitus non equidem facile dixerim—non Hercule magis quam circumactorum simul tinnitus siderum suosque volventium orbis—an dulcis quidam et incredibili suavitate concentus. nobis qui intus agimus iuxta diebus noctibusque
 7 tacitus labitur mundus. esse innumeras ei effigies animalium rerumque cunctarum impressas nec, ut in volucrum notamus ovis, levitate continua lubricum corpus, quod clarissimi auctores dixere, rerum argumentis indicatur, quoniam inde deciduis rerum omnium seminibus innumeris,¹ in mari praecipue, ac plerumque confusis monstrificae gignantur effigies, praeterea visus probatione, alibi ursi, tauri alibi, alibi plaustrum,² alibi litterae figura, candidiore medio per verticem circulo.

8 Equidem et consensu gentium moveor. namque et Graeci³ nomine ornamentum appellavere eum et nos a perfecta absolutaque elegantia mundum. caelum quidem haut dubie caelati argumento dici-
 9 mus,⁴ ut interpretatur M. Varro. adiuvat rerum ordo

¹ *Rackham*: innumerae.

² alibi plaustrum *hic Rackham*, ante aut post alibi ursi aut om. *codd.*

³ *v.l.* nam quem κόσμον Graeci.

⁴ *v.l.* diximus.

^a Deltoton, the constellation of the Triangle, Greek Δ.

^b κόσμος.

^c *Mundus* (adj.) means 'neat,' 'elegant.'

doubtful. Whether the sound of this vast mass whirling in unceasing rotation is of enormous volume and consequently beyond the capacity of our ears to perceive, for my own part I cannot easily say—any more in fact than whether this is true of the tinkling of the stars that travel round with it, revolving in their own orbits; or whether it emits a sweet harmonious music that is beyond belief charming. To us who live within it the world glides silently alike by day and night. Stamped upon it are countless figures of animals and objects of all kinds—it is not the case, as has been stated by very famous authors, that its structure has an even surface of unbroken smoothness, like that which we observe in birds' eggs: this is proved by the evidence of the facts, since from seeds of all these objects, falling from the sky in countless numbers, particularly in the sea, and usually mixed together, monstrous shapes are generated; and also by the testimony of sight—in one place the figure of a bear, in another of a bull, in another a wain, in another a letter of the alphabet,^a the middle of the circle across the pole being more radiant.

For my own part I am also influenced by the agreement of the nations. The Greeks have designated the world by a word that means 'ornament,'^b and we have given it the name of *mundus*,^c because of its perfect finish and grace! As for our word *caelum*, it undoubtedly has the signification 'engraved,' as is explained by Marcus Varro.^d Further assistance is contributed by its orderly

The world's beauty.

^d *De Lingua Latina* V 18: engraved (*caelum* 'chisel,' *caedere*) with the figures of the constellations. *Caelum*, 'the vault of the sky,' is really for *cavilum*, from *cavus*.

discripto circulo qui signifer vocatur in duodecim animalium effigies, et per illas solis cursus congruens tot saeculis ratio.

- 10 IV. Nec de elementis video dubitari quattuor esse ea: igneum summum, inde tot stellarum illos conluentium oculos; proximum spiritum quem Graeci nostrique eodem vocabulo aera appellant, vitalem hunc et per cuncta rerum meabilem totoque
 11 elemento librari medio spatii tellurem. ita mutuo complexu diversitatis effici nexum, et levia ponderibus inhiberi quo minus evolent, contraque gravia ne ruant suspendi levibus in sublime tendentibus. sic pari in diversa nisu in suo quaeque loco¹ consistere, inquieto mundi ipsius constricta circuitu, quo semper in se recurrente² imam atque mediam in toto esse terram, eandemque universo cardine stare pendentem librantemque per quae pendeat; ita solam immobilem circa eam volubili universitate eandemque ex omnibus necti eidemque omnia inniti.³
 12 inter hanc caelumque eodem spiritu pendent certis discreta spatiis septem sidera quae ab incessu vocamus errantia, cum errent nulla minus illis. eorum medius sol fertur amplissima magnitudine ac

¹ loco add. *Rackham* (sic? *Campbell*).

² *C. F. W. Müller*: currente.

³ *v.l.* innecti.

* 'Wanderers,' *πλανήταις*.

structure, the circle called the Zodiac being marked out into the likenesses of twelve animals; and also by the uniform regularity in so many centuries of the sun's progress through these signs.

IV. As regards the elements also I observe that they are accepted as being four in number: topmost the element of fire, source of yonder eyes of all those blazing stars; next the vapour which the Greeks and our own nation call by the same name, air—this is the principle of life, and penetrates all the universe and is intertwined with the whole; suspended by its force in the centre of space is poised the earth, and with it the fourth element, that of the waters. Thus the mutual embrace of the unlike results in an interlacing, the light substances being prevented by the heavy ones from flying up, while on the contrary the heavy substances are held from crashing down by the upward tendency of the light ones. In this way owing to an equal urge in opposite directions the elements remain stationary, each in its own place, bound together by the unresting revolution of the world itself; and with this always running back to its starting-point, the earth is the lowest and central object in the whole, and stays suspended at the pivot of the universe and also balancing the bodies to which its suspension is due; thus being alone motionless with the universe revolving round her she both hangs attached to them all and at the same time is that on which they all rest. Upheld by the same vapour between earth and heaven, at definite spaces apart, hang the seven stars which owing to their motion we call 'planets,'^a although no stars wander less than they do. In the midst of these moves the sun, whose magnitude and power are the greatest,

Four elements.

The planets.

The sun.

13 potestate, nec temporum modo terrarumque sed siderum etiam ipsorum caelique rector. hunc esse mundi totius animum ac planius mentem, hunc principale naturae regimen ac numen credere decet opera eius aestimantes. hic lucem rebus ministrat aufertque tenebras, hic reliqua sidera occultat inlustrat, hic vices temporum annumque semper renascentem ex usu naturae temperat, hic caeli tristitiam discutit atque etiam humani nubila animi serenat, hic suum lumen ceteris quoque sideribus fenerat, praeclarus, eximius, omnia intuens, omnia etiam exaudiens, ut principi litterarum Homero placuisse in uno eo video.

14 V. Quapropter effigiem dei formamque quaerere inbecillitatis humanae reor. quisquis est deus, si modo est aliquis,¹ et quacumque in parte, totus est sensus, totus visus, totus auditus, totus animae, totus animi, totus sui. Innumeros quidem credere atque etiam ex vitiis hominum, non virtutibus tantum,² ut Pudicitiam, Concordiam, Mentem, Spem, Honorem, Clementiam, Fidem, aut (ut Democrito placuit) duos omnino, Poenam et Beneficium, maiorem ad socordiam accedit. fragilis et laboriosa mortalitas in partes ista digessit infirmitatis suae memor, ut portionibus coleret qui quisque³ maxime indigeret. itaque nomina⁴ alia aliis gentibus et numina in iisdem innumerabilia invenimus, inferis quoque in genera discriptis, morbisque et multis

¹ *Vulg.* alius.

² *Mayhoff*: atque etiam ex vitiis hominum *aut* atque tam ex virtutibus vitiisque hominum *codd.*

³ *Mayhoff*: quidque quo *codd.* ⁴ numina? *Rackham.*

^a A variant gives 'if only he be other (than the world).'

^b No other authority records this of Democritus.

and who is the ruler not only of the seasons and of the lands, but even of the stars themselves and of the heaven. Taking into account all that he effects, we must believe him to be the soul, or more precisely the mind, of the whole world, the supreme ruling principle and divinity of nature. He furnishes the world with light and removes darkness, he obscures and he illumines the rest of the stars, he regulates in accord with nature's precedent the changes of the seasons and the continuous re-birth of the year, he dissipates the gloom of heaven and even calms the storm-clouds of the mind of man, he lends his light to the rest of the stars also; he is glorious and pre-eminent, all-seeing and even all-hearing—this I observe that Homer the prince of literature held to be true in the case of the sun alone.

V. For this reason I deem it a mark of human weakness to seek to discover the shape and form of God. Whoever God is—provided there is a God^a—and in whatever region he is, he consists wholly of sense, sight and hearing, wholly of soul, wholly of mind, wholly of himself. To believe in gods without number, and gods corresponding to men's vices as well as to their virtues, like the Goddesses of Modesty, Concord, Intelligence, Hope, Honour, Mercy and Faith—or else, as Democritus held,^b only two, Punishment and Reward, reaches an even greater height of folly. Frail, toiling mortality, remembering its own weakness, has divided such deities into groups, so as to worship in sections, each the deity he is most in need of. Consequently different races have different names for the deities,^c and we find countless deities in the same races, even those of the lower

The divine Nature inscrutable.

^c Or, altering the text, 'have different deities.'

etiam pestibus, dum esse placatas¹ trepido metu
 16 cupimus. ideoque etiam publice Febris fanum in
 Palatio dicatum est, Orbonae ad aedem Larum et
 ara Malae Fortunae Esquiliis. quamobrem maior
 caelitum populus etiam quam hominum intellegi
 potest, cum singuli quoque ex semetipsis totidem
 deos faciant Iunones Geniosque adoptando sibi,
 gentes vero quaedam animalia et aliqua etiam
 obscena pro dis habeant ac multa dictu magis
 pudenda, per fetidos cibos et alia² similia iurantes.
 17 matrimonia quidem inter deos credi tantoque aevo
 ex eis neminem nasci, et alios esse grandaevos
 semper canosque, alios iuvenes atque pueros, atri-
 colores, aligeros, claudos, ovo editos et alternis
 diebus viventes morientesque, puerilium prope
 deliramentorum est; sed super omnem inpuentiam
 adulteria inter ipsos fingi, mox iurgia et odia, atque
 18 etiam furtorum esse et scelerum numina. deus est
 mortali iuvare mortalem, et haec ad aeternam gloriam
 via: hac proceres iere Romani, hac nunc caelesti
 passu cum liberis suis vadit maximus omnis aevi
 rector Vespasianus Augustus fessis rebus subveniens.
 19 hic est vetustissimus referendi bene merentibus
 gratiam mos, ut tales numinibus adscribant. quippe

¹ *v.l.* placata.

² *v.l.* per fetidas cepas, allia et (cf. XIX. 101).

world being classified into groups, and diseases
 and also many forms of plague, in our nervous
 anxiety to get them placated. Because of this
 there is actually a Temple of Fever consecrated by
 the nation on the Palatine Hill, and one of Bereave-
 ment at the Temple of the Household Deities, and
 an Altar of Misfortune on the Esquiline. For this
 reason we can infer a larger population of celestials
 than of human beings, as individuals also make an
 equal number of gods on their own, by adopting
 their own private Junos and Genii; while certain
 nations have animals, even some loathsome ones, for
 gods, and many things still more disgraceful to tell
 of—swearing by rotten articles of food and other
 things of that sort. To believe even in marriages
 taking place between gods, without anybody all
 through the long ages of time being born as a
 result of them, and that some are always old and
 grey, others youths and boys, and gods with dusky
 complexions, winged, lame, born from eggs, living
 and dying on alternate days—this almost ranks
 with the mad fancies of children; but it passes all
 bounds of shamelessness to invent acts of adultery
 taking place between the gods themselves, followed
 by altercation and enmity, and the existence of
 deities of theft and of crime. For mortal to aid
 mortal—this is god; and this is the road to eternal
 glory: by this road went our Roman chieftains, by
 this road now proceeds with heavenward step, escorted
 by his children, the greatest ruler of all time, His
 Majesty Vespasian, coming to the succour of an
 exhausted world. To enrol such men among the
 deities is the most ancient method of paying them
 gratitude for their benefactions. In fact the names

PLINY: NATURAL HISTORY

- et aliorum nomina deorum et quae supra retuli siderum ex hominum nata sunt meritis: Iovem quidem aut Mercurium aliterve alios inter se vocari et esse caelestem nomenclaturam quis non interpretatione naturae fateatur? inridendum agere curam rerum humanarum illud quicquid est summum. anne tam tristi atque multiplici ministerio non pollui credamus? dubitemusne? vix prope¹ est iudicare utrum magis conducat generi humano, quando aliis nullus est deorum respectus, aliis
- 21 pudendus: externis famulantur sacris, ac digitis deos gestant; monstra quoque quae colunt damnant, et excogitant cibos; imperia dira in ipsos se² ne somno quidem quietos³ inrogant; non matrimonia, non liberos, non denique quicquam aliud nisi iubentibus sacris deligunt; alii in Capitolio fallunt ac fulminantem periurant Iovem—et hos iuvant scelera, illos sacra sua poenis agunt.
- 22 Invenit tamen inter has utrasque sententias medium sibi ipsa mortalitas numen, quo minus etiam plana de deo coniectatio esset: toto quippe mundo et omnibus locis omnibusque horis omnium vocibus Fortuna sola invocatur ac nominatur, una accusatur, rea una agitur, una cogitatur,⁴ sola laudatur, sola arguitur et cum conviciis colitur: volubilis, a plerisque vero et caeca existimata, vaga, inconstans,

¹ Vix prodest *Mayhoff*, vix profecto *Dellefsen*.

² *se add. Rackham*.

³ *Rackham*: quieto.

⁴ [una cogitatur] *Campbell*.

^a I.e. engraved on rings.

^b I.e. whether to rear or to expose the children born to them.

of the other gods, and also of the stars that I have mentioned above, originated from the services of men: at all events who would not admit that it is the interpretation of men's characters that prompts them to call each other Jupiter or Mercury or other names, and that originates the nomenclature of heaven? That that supreme being, whate'er it be, pays heed to man's affairs is a ridiculous notion. Can we believe that it would not be defiled by so gloomy and so multifarious a duty? Can we doubt it? It is scarcely pertinent to determine which is more profitable for the human race, when some men pay no regard to the gods at all and the regard paid by others is of a shameful nature: they serve as the lackeys of foreign ritual, and they carry gods on their fingers^a; also they pass sentence of punishment upon the monsters they worship, and devise elaborate viands for them; they subject themselves to awful tyrannies, so as to find no repose even in sleep; they do not decide on marriage or having a family^b or indeed anything else except by the command of sacrifices; others cheat in the very Capitol and swear false oaths by Jupiter who wields the thunder-bolts—and these indeed make a profit out of their crimes, whereas the others are penalized by their religious observances.

Nevertheless mortality has rendered our guesses about God even more obscure by inventing for itself a deity intermediate between these two conceptions. Everywhere in the whole world at every hour by all men's voices Fortune alone is invoked and named, alone accused, alone impeached, alone pondered, alone applauded, alone rebuked and visited with reproaches; deemed volatile and indeed by most men blind as well, wayward, inconstant, uncertain, fickle in her favours

Deification of Fortuna.

- incerta, varia indignorumque faulrix. huic omnia
 expensa, huic omnia feruntur accepta, et in tota
 ratione mortalium sola utramque paginam facit;
 adeoque obnoxii sumus sorti,¹ ut sors ipsa pro deo
 23 sit, qua deus probatur incertus. pars alia et hanc
 pellit astroque suo eventus adsignat et nascendi
 legibus: semelque in omnes futuros umquam deo
 decretum, in reliquom vero otium datum. sedere
 coepit sententia haec, pariterque et eruditum vulgus
 24 et rude in eam cursu vadit: ecce fulgurum monitus,
 oraculorum praescita, haruspicum praedicta, atque
 etiam parva dictu in auguriis, sternumenta et
 offensiones pedum. divus Augustus prodidit laevum
 sibi calceum praepostere inductum quo die seditione
 25 militari prope adflictus est. quae singula improvidam
 mortalitatem involvont, solum ut inter ista vel
 certum sit nihil esse certi nec quicquam miserius
 homine aut superbius: ceteris quippe animantium
 sola victus cura est, in quo sponte naturae benignitas
 sufficit, uno quidem vel praeferendo cunctis bonis,
 quod de gloria, de pecunia, de² ambitione, superque
 de morte non cogitant.
- 26 Verum in his deos agere curam rerum humanarum
 credi ex usu vitae est, poenasque maleficiis aliquando
 seras, occupato deo in tanta mole, numquam autem

¹ *Edd.*: obnoxiae sumus sortis.

² de *add.* Rackham.

and favouring the unworthy. To her is debited all that is spent and credited all that is received, she alone fills both pages in the whole of mortals' account; and we are so much at the mercy of chance that Chance herself, by whom God is proved uncertain, takes the place of God. Another set of people banishes fortune also, and attributes events to its star and to the laws of birth, holding that for all men that ever are to be God's decree has been enacted once for all, while for the rest of time leisure has been vouchsafed to Him. This belief begins to take root, and the learned and unlearned mob alike go marching on towards it at the double: witness the warnings drawn from lightning, the forecasts made by oracles, the prophecies of augurs, and even inconsiderable trifles—a sneeze, a stumble—counted as omens. His late Majesty put abroad a story that on the day on which he was almost overthrown by a mutiny in the army he had put his left boot on the wrong foot. This series of instances entangles unforeseeing mortality, so that among these things but one thing is in the least certain—that nothing certain exists, and that nothing is more pitiable, or more presumptuous, than man! inasmuch as with the rest of living creatures their sole anxiety is for the means of life, in which nature's bounty of itself suffices, the one blessing indeed that is actually preferable to every other being the fact that they do not think about glory, money, ambition, and above all death.

But it agrees with life's experience to believe that in these matters the gods exercise an interest in human affairs; and that punishment for wickedness, though sometimes tardy, as God is occupied in so vast a mass of things, yet is never frustrated; and

The powers of deity.

inritas esse, nec ideo proximum illi genitum hominem
 27 ut vilitate iuxta beluas esset. imperfectae vero in
 homine naturae praecipua solatia, ne deum quidem
 posse omnia,—namque nec sibi potest mortem
 consciscere, si velit, quod homini dedit optimum in
 tantis vitae poenis, nec mortales aeternitate donare
 aut revocare defunctos, nec facere ut qui vixit non
 vixerit, qui honores gessit non gesserit,—nullumque
 habere in praeterita ius praeterquam oblivionis,
 atque (ut facetis quoque argumentis societas haec
 cum deo copuletur) ut bis dena viginti non sint
 aut multa similiter efficere non posse: per quae
 declaratur haut dubie naturae potentia, idque esse
 quod deum vocemus. in haec divertisse non fuerit
 alienum, volgata iam¹ propter adsiduam quae-
 stionem de deo.

28 VI. Hinc redeamus ad reliqua naturae. sidera,
 quae adfixa diximus mundo, non ita² ut existimat
 volgus, singulis attributa nobis et clara divitibus,
 minora pauperibus, obscura defectis ac pro sorte
 cuiusque lucentia adnumerata mortalibus, nec cum

¹ *Deilefsen*: volgatam (v.l. propter volgatam assidue).

² ita *Deilefsen*: illa.

that man was not born God's next of kin for the
 purpose of approximating to the beasts in vileness.
 But the chief consolations for nature's imperfection
 in the case of man are that not even for God are all
 things possible—for he cannot, even if he wishes,
 commit suicide, the supreme boon that he has
 bestowed on man among all the penalties of life,
 nor bestow eternity on mortals or recall the deceased,
 nor cause a man that has lived not to have lived or
 one that has held high office not to have held it—and
 that he has no power over what is past save to forget
 it, and (to link our fellowship with God by means of
 frivolous arguments as well) that he cannot cause
 twice ten not to be twenty^a or do many things on
 similar lines: which facts unquestionably demonstrate
 the power of nature, and prove that it is this that we
 mean by the word 'God.' It will not have been
 irrelevant to have diverged to these topics, which
 have already been widely disseminated because of
 the unceasing enquiry into the nature of God.

VI. Let us return from these questions to the
 remaining facts of nature. We have stated^b that the
 stars are attached to the firmament, not assigned
 to each of us in the way in which the vulgar believe,
 and dealt out to mortals with a degree of radiance
 proportionate to the lot of each, the brightest stars
 to the rich, the smaller ones to the poor, the dim
 to those who are worn out; they do not each
 rise with their own human being, nor indicate by

*Astrology
discarded.*

^a Cf. A. E. Housman *Last Poems* XXXV:

—To think that two and two are four
 And neither five nor three,
 The heart of man has long been sore
 And long 'tis like to be.

^b Above, §§ 7-9.

suo quaeque homine oriuntur¹ nec aliquem exstingui
 29 decidua significant. non tanta caelo societas nobis-
 cum est ut nostro fato mortalis sit ibi quoque
 siderum fulgor. illa nimio alimento tracti umoris
 ignea vi abundantiam reddunt cum decidere cre-
 30 liquore olei notamus accidere. ceterum aeterna
 caelestibus est natura intertextentibus mundum
 intextoque concretis, potentia autem ad terram
 magnopere eorum pertinens, quae propter effectus
 claritatemque et magnitudinem in tanta subtilitate
 nosci potuerunt, sicut suo demonstrabimus loco.
 31 circulorum quoque caeli ratio in terrae mentione
 aptius dicetur, quando ad eam tota pertinet, signiferi
 modo inventionibus² non dilatis. obliquitatem eius
 intellexisse, hoc est rerum fores aperuisse, Anaxi-
 mander Milesius traditur primus Olympiade quin-
 quagesima octava, signa deinde in eo Cleostratus,
 et prima arietis ac sagittarii, sphaeram ipsam ante
 multo Atlas.

32 Nunc relicto mundi ipsius corpore reliqua inter
 caelum terrasque tractentur. summum esse quod
 vocant Saturni sidus ideoque minimum videri et
 maximo ambire circulo ac tricesimo anno cum
 brevissime ad³ sedis suae principia regredi certum
 est; omnium autem errantium siderum meatus,

¹ *Detlefsen*: orta oriuntur aut orta moriuntur.

² inventoribus *Sabell*.

³ *v.l.* ad brevissima *codd.* fere omnes.

^a XVIII 210 ff.

^b VI 211 ff.

^c 548-545 B.C.

their fall that someone's life is being extinguished. There is no such close alliance between us and the sky that the radiance of the stars there also shares our fate of mortality. When the stars are believed *Astronomy.* to fall, what happens is that owing to their being overfed with a draught of liquid they give back the surplus with a fiery flash, just as with us also we see this occur with a stream of oil when lamps are lit. But the heavenly bodies have a nature that is eternal—they interweave the world and are blended with its weft; yet their potency has a powerful influence on the earth, indeed it is owing to the effects that they produce and to their brilliance and magnitude that it has been possible for them to become known with such a degree of precision, as we shall show in the proper place.^a Also the system of the revolutions of the sky will be more appropriately stated when we deal with geography,^b since it is entirely related to the earth; only we must not postpone the discoveries that have been made as to the zodiac. Tradition says that Anaximander of Miletus in the fifty-eighth Olympiad^c was the first person to discover the obliquity of the zodiac, that is, to open the portals of science; and that next Cleostratus explained the signs in it, beginning with the Ram and the Archer; the firmament itself having been explained long before by Atlas.

Let us now leave the frame of the world itself and *The planets.* treat the remaining bodies situated between the sky and the earth. The following points are certain: (1) The star called Saturn's is the highest and consequently looks the smallest and revolves in the largest orbit, returning in thirty years at the shortest to its initial station. (2) The motions of all the planets,

- interque ea solis et lunae, contrarium mundo agere cursum, id est laevom, illo semper in dextram praecipiti; et quamvis adsidua conversione immensae celeritatis attollantur ab eo rapianturque in occasum, adverso tamen ire motu per suos quaeque passus; ita fieri ne convolutus aer eandem in partem aeterna mundi vertigine ignavo globo torpeat sed fundatur adverso siderum verbere discretus et digestus;
- 34 Saturni autem sidus gelidae ac regentis esse naturae, multumque ex eo inferiorem Iovis circumum et ideo motu celeriore duodenis circumagi annis; tertium Martis, quod quidam Herculis vocant, igne ardens solis vicinitate, binis fere annis converti, ideoque huius ardore nimio et rigore Saturni interiectum ambobus ex utroque temperari Iovem salutaremque fieri;
- 35 dein solis meatum esse partium quidem trecentarum sexaginta, sed ut observatio umbrarum eius redeat ad metas,¹ quinos annis dies adici superque quartam partem diei; quam ob causam quinto cuique² anno unus intercalarius dies additur ut temporum ratio solis itineri congruat.
- 36 Infra solem ambit ingens sidus appellatum Veneris, alterno meatu vagum ipsisque cognominibus aemulum solis ac lunae: praeveniens quippe³ et ante matutinum exoriens Luciferi nomen accipit ut sol alter diemque maturans, contra ab occasu refulgens nuncupatur Vesper ut prorogans lucem vicemque

¹ *Dellefsen* (metam? *Rackham*): notas aut motus.

² cuique *add. Rackham* (quoque *Harduin*).

³ quippe solem? *Rackham*.

^a In Roman arithmetic, for example, 1938 would be called the fifth year after 1934.

and among them the sun and moon, follow a course contrary to that of the world, namely to the left, the world always running to the right. (3) Although they are borne on by it and carried westward with an unceasing revolution of immeasurable velocity, nevertheless they travel with an opposite motion along their respective tracks. (4) Thus it comes about that the air is not massed in a dull lethargic ball by revolving in the same direction because of the eternal rotation of the world, but is scattered into separate portions by the opposite impact of the stars. (5) Saturn is of a cold and frozen nature. The orbit of Jupiter is much below it and therefore revolves much faster, completing one rotation every twelve years. The third star is Mars, called by some Hercules; owing to the proximity of the sun it has a fiery glow; it revolves once in about two years, and consequently, owing to its excessive heat and Saturn's frost, Jupiter being situated between them combines the influence of each and is rendered healthy. (6) Next, the sun's course is divided into 360 parts, but in order that an observation taken of the shadows that it casts may come round to the starting-point, five and a quarter days *per annum* are added; consequently to every fourth^a year an intercalary day is added to make our chronology tally with the course of the sun.

Below the sun revolves a very large star named Venus, which varies its course alternately, and whose alternative names in themselves indicate its rivalry with the sun and moon—when in advance and rising before dawn it receives the name of Lucifer, as being another sun and bringing the dawn, whereas when it shines after sunset it is named Vesper, as prolonging

- 37 lunae reddens. quam naturam eius Pythagoras Samius primus deprehendit Olympiade circiter XLII, qui fuit urbis Romae annus CXLII. iam magnitudine extra cuncta alia sidera est, claritatis quidem tantae ut unius huius stellae radiis umbrae reddantur. itaque et in magno nominum ambitu est: alii enim Iunonis, alii Isidis, alii Matris Deum
 38 appellavere. huius natura cuncta generantur in terris; namque in alterutro exortu genitali rore conspergens non terrae modo conceptus inplet, verum animantium quoque omnium stimulat. signiferi autem ambitum peragit trecenis et duodequinguenis diebus, a sole numquam absistens partibus sex atque quadraginta longius, ut Timaeo
 39 placet. simili ratione, sed nequaquam magnitudine aut vi, proximum illi Mercurii sidus, a quibusdam appellatum Apollinis, inferiore circulo fertur novem diebus ociore ambitu, modo ante solis exortum modo post occasum splendens, numquam ab eo XXII¹ partibus remotior, ut Cidenas et Sosigenes docent. ideo et peculiaris horum siderum ratio est neque
 40 communis cum supra dictis; nam ea et quarta parte caeli a sole abesse et tertia, et adversa soli saepe cernuntur, maioresque alios habent cuncta plenae conversionis ambitus in magni anni ratione dicendos.
 41 Sed omnium admirationem vincit novissimum sidus, terris familiarissimum et in tenebrarum

¹ XXIII *Hermolaus Barbarus.*

^a 612-609 B.C.

^b 753 B.C.

^c *magnum annum . . . quatum efficitur cum solis et lunae et quinque errantium ad eandem inter se comparationem confectis omnium spatiis est facta conversio, Cic. N.D. II. 51. The*

the daylight, or as being a deputy for the moon. This property of Venus was first discovered by Pythagoras of Samos about the 42nd Olympiad,^a 142 years after the foundation^b of Rome. Further it surpasses all the other stars in magnitude, and is so brilliant that alone among stars it casts a shadow by its rays. Consequently there is a great competition to give it a name, some having called it Juno, others Isis, others the Mother of the Gods. Its influence is the cause of the birth of all things upon earth; at both of its risings it scatters a genital dew with which it not only fills the conceptive organs of the earth but also stimulates those of all animals. It completes the circuit of the zodiac every 348 days, and according to Timaeus is never more than 46 degrees distant from the sun. The star next to Venus is Mercury, by some called Apollo; it has a similar orbit, but is by no means similar in magnitude or power. It travels in a lower circle, with a revolution nine days quicker, shining sometimes before sunrise and sometimes after sunset, but according to Cidenas and Sosigenes never more than 22 degrees away from the sun. Consequently the course of these stars also is peculiar, and not shared by those above-mentioned: those are often observed to be a quarter or a third of the heaven away from the sun and travelling against the sun, and they all have other larger circuits of full revolution, the specification of which belongs to the theory of the Great Year.^c

But the wonder of everyone is vanquished by the *The earth* last star, the one most familiar to the earth, and

theory of the Cosmic Year is attributed to the Pythagoreans and to Heraclitus; Plato, *Timaeus* 39, gives its length as 10,000 years.

remedium ab natura repertum, lunae. multiformi haec ambage torsit ingenia contemplantium et proximum ignorari maxime sidus indignantium, cres-
 42 cens semper aut senescens, et modo curvata in cornua falcis,¹ modo aequa portione divisa, modo sinuata in orbem, maculosa eademque subito praenitens, immensa orbe pleno ac repente nulla, alias pernox
 43 alias sera et parte diei solis lucem adiuvans, deficiens et in defectu tamen conspicua, quae mensis exitu latet cum laborare non creditur; iam vero humilis, iam² excelsa, et ne id quidem uno modo, sed alias admota caelo alias contigua montibus, nunc in aquilonem elata nunc in austros deiecta. quae singula in ea deprehendit hominum primus Endymion; ob id amor³ eius⁴ fama traditur. non sumus profecto grati erga eos qui labore curaque lucem nobis aperuere in hac luce, miraque humani ingeni peste sanguinem et caedes condere annalibus iuvat, ut scelera hominum noscantur mundi ipsius ignaris.
 44 Proxima ergo cardini ideoque minimo ambitu, vicenis diebus septenisque et tertia diei parte peragit spatia eadem quae Saturni sidus altissimum triginta, ut dictum est, annis. dein morata in coitu solis biduo, cum tardissime, a tricesima luce rursus ad

¹ Jan: facie.

² iam add. Rackham: v.l. et excelsa.

³ Mayhoff: amore.

⁴ v.l. eius captus.

^a An eclipse of sun or moon was often called labor: Virgil, *Aen.* I. 742, *Georg.* II. 478.

devised by nature to serve as a remedy for the shadows of darkness—the moon. By the riddle of her transformations she has racked the wits of observers, who are ashamed that the star which is nearest should be the one about which we know least—always waxing or waning, and now curved into the horns of a sickle, now just halved in size, now rounded into a circle; spotted and then suddenly shining clear; vast and full-orbed, and then all of a sudden not there at all; at one time shining all night and at another rising late and for a part of the day augmenting the light of the sun, eclipsed
Eclipses and nevertheless visible during the eclipse, invisible at the end of the month when she is not believed to be in trouble^a; again at one time low down and at another up aloft, and not even this in a uniform way, but sometimes raised to the sky and sometimes touching the mountain-tops, now borne up to the North and now carried down to the South. The first human being to observe all these facts about her was Endymion—which accounts for the traditional story of his love for her. We forsooth feel no gratitude towards those whose assiduous toil has given us illumination on the subject of this luminary, while owing to a curious disease of the human mind we are pleased to enshrine in history records of bloodshed and slaughter, so that persons ignorant of the facts of the world may be acquainted with the crimes of mankind.

The moon then is nearest to the pole, and there-
The moon. fore has the smallest orbit, completing the same distance every $27\frac{1}{3}$ days that Saturn the highest star covers, as we have said, in 30 years. Then she lingers two days in conjunction with the sun, and after the

easdem vices exit, haut scio an omnium quae in caelo
 pernosci potuerunt magistra: in duodecim mensium
 45 spatia oportere dividi annum, quando ipsa totiens
 solem redeuntem ad principia consequitur; solis
 fulgore eam ut reliqua siderum regi, siquidem in
 totum mutuata ab eo luce fulgere, qualem in reper-
 cussu aquae volitare conspicimus; ideo molliore et
 imperfecta vi solvere tantum umorem, atque etiam
 augere, quem solis radii absumant; ideo et inaequali
 lumine adspici quia ex adverso demum plena reliquis
 diebus tantum ex se terris ostendat quantum ex
 46 sole ipsa concipiat; in coitu quidem non cerni,
 quoniam haustum omnem lucis adversa illo regerat
 unde acceperit; sidera vero haut dubie humore
 terreno pasci, quia dimidio orbe nonnumquam
 maculosa cernatur, scilicet nondum suppetente ad
 hauriendum ultra iusta vi—maculas enim non aliud
 esse quam terrae raptas cum humore sordes; de-
 fectus autem suos et solis, rem in tota contemplatione
 naturae maxime miram et ostento similem, magni-
 47 tudinum umbraeque indices exsistere. VII. quippe
 manifestum est solem interventu lunae occultari lun-
 amque terrae obiectu, ac vices reddi, eosdem solis

^a This is proved of the moon in the words that follow, and thence assumed to apply also to the other heavenly bodies.

30th day at latest sets out again on the same course—
 being perhaps our teacher as to all the facts that it
 has been possible to observe in the heavens; (1) that
 the year is to be divided into twelve monthly
 spaces, because she herself that number of times
 follows the sun in his return to his starting point;
 (2) that she is governed by the sun's radiance as are
 the rest of the stars, as in fact she shines with a light
 entirely borrowed from him, like the light which we
 see flickering reflected in water; (3) that conse-
 quently she only causes water to evaporate with a
 rather gentle and imperfect force, and indeed
 increases its quantity, whereas the sun's rays dry it
 up; (4) also that the reason why she is seen to vary
 in her light is that she is full only when opposite to
 the sun, and on the remaining days shows as much
 light from herself to the earth as she herself con-
 ceives from the sun; though (5) she is indeed
 invisible when in conjunction with the sun, because
 being turned towards him she gives back the entire
 draught of light to the source from which she receives
 it; (6) but that the stars are undoubtedly nourished
 by the moisture of the earth,^a since she is sometimes
 seen spotted in half her orb, clearly because she has
 not yet got sufficient strength to go on drinking—
 her spots being merely dirt from the earth taken up
 with the moisture; (7) but that her eclipses and
 those of the sun, the most marvellous and indeed
 portentous occurrence in the whole of our observa-
 tion of nature, serve as indications of their dimensions
 and shadow. VII. It is in fact obvious that the
 sun is hidden by the passage across it of the moon,
 and the moon by the interposition of the earth, and
 that they retaliate on one another, the same rays of

Eclipse.

- radios luna interposito suo auferente terrae terraque lunae: hac subeunte repentinas obduci terrae¹ tenebras rursumque illius umbra sidus hebetari, neque aliud esse noctem quam terrae umbram, figuram autem umbrae similem metae ac turbini inverso, quando mucrone tantum ingruat neque lunae excedat altitudinem, quoniam nullum aliud sidus eodem modo obscuretur et talis figura semper in mucronem deficiat: spatio quidem consumi umbras indicio sunt volucrum
 48 praealti volatus. ergo confinium illis est aeris terminus initiumque aetheris; supra lunam pura omnia ac diuturnae lucis plena, a nobis autem per noctem cernuntur sidera ut reliqua lumina in tenebris. et propter has causas nocturno tempore deficit luna; statim autem atque menstrui non sunt utriusque defectus, propter obliquitatem signiferi lunaeque multivagos, ut dictum est,² flexus, non semper in scripulis partium congruente siderum motu.
- 49 VIII. Haec ratio mortales animos subducit in caelum, ac velut inde contemplantibus trium maximarum rerum naturae partium magnitudinem detegit; non posset quippe totus sol adimi terris intercedente luna si terra maior esset quam luna. certior³ ex utraque vastitas solis aperietur,⁴ ut non

¹ terrae *add.* (?) *Mayhoff.*

² [ut dictum est] *edd. vet.*

³ *Beda: tertia codd.*

⁴ aperietur (*viz.* § 51 f.): *v.l.* aperitur.

^a I.e. by the intervention of the earth.

^b In § 51 f. A variant gives 'the sun's magnitude is shown as third in the series, starting from the two others.'

the sun being taken away from the earth by the moon intervening and from the moon by the earth: at the transit of the former a sudden shadow passes over the earth, and in return the shadow of the latter dims the heavenly body (the moon), and the darkness is merely the earth's shadow, but the shape of the shadow is conical, resembling a spinning-top upside down, as it impinges only with its point and does not go beyond the altitude of the moon, because no other star is obscured in the same way,^a and a conical figure always tapers off into a point: that shadows are made to disappear by distance is proved when birds fly to extreme heights. Consequently the frontier between the moon and the other heavenly bodies is at the point where the air ends and the aether begins. All the space above the moon is clear and filled with continual light, but to us the stars are visible through the night in the same way as other lights in shadows. And these are the reasons why the moon wanes in the night-time; but both of her wanings are irregular and not monthly, because of the slant of the zodiac and the widely varying curves of the moon's course, as has been stated, the motion of the heavenly bodies not always tallying in minute fractional quantities.

VIII. This theory leads mortal minds upward to heaven, and discloses to their observation from that height, as it were, the greatness of the three greatest parts of the universe; clearly it would not be possible for the whole of the sun to be eclipsed from the earth by the passage of the moon between them if the earth were larger than the moon. The vast size of the sun will be shown^b with the more certainty from the two bodies, so that there is no need to investigate

The sun.

50 sit necesse amplitudinem eius oculorum argumentis atque coniectura animi scrutari: immensum esse, quia arborum in limitibus porrectarum in quotlibet passuum milia umbras paribus iaciat intervallis tamquam toto spatio medius, et quia per aequinoctium omnibus in meridiana plaga habitantibus simul fiat a vertice, item quia circa solstitialem circulum habitantium meridie ad septentrionem umbrae cadant, ortu vero ad occasum, quae fieri nullo modo possent nisi multo quam terra maior esset, et quod montem Idam exoriens latitudine exsuperet, dextra laevaue large amplectens, praesertim tanto discretus intervallo.

51 Defectus lunae magnitudinem eius haut dubia ratione declarat, sicut terrae parvitatem ipse deficiens. namque cum sint tres umbrarum figurae, constetque, si par lumini sit materia quae iaciat, umbram columnae¹ effigie iaci nec habere finem, si vero maior materia quam lumen, turbinis recti, ut sit imum eius angustissimum et simili modo infinita longitudo, si minor materia quam lux, metae existere effigiem in cacuminis finem desinentem, talemque cerni umbram deficiente luna, palam fit, ut nulla amplius relinquatur dubitatio solem superare
52 magnitudinem terrae. id quidem et tacitis naturae ipsius indiciis: cur enim partitis vicibus anni brumalis

¹ cylindri? *Rackham.*

^a I.e. central at every point in the space alike.

its size by the evidence of the eyes and by logical inference, arguing that it is immeasurably large for the following reasons: (1) the shadow that it throws of rows of trees along the balks of fields are at equal distances apart for ever so many miles, just as if over the whole space the sun were in the centre;^a (2) during the equinoxes it reaches the vertical simultaneously for all the inhabitants of the southern region; (3) the shadows of the people living round the Tropic of Cancer fall northward at midday but westward at sunrise, which could not happen unless the sun were much larger than the earth; (4) when it is rising its breadth exceeds Mount Ida, overlapping it widely right and left—and that though it is separated from it by so great a distance.

The eclipse of the moon supplies indubitable proof of the size of the sun, just as the sun itself when it suffers eclipse proves the smallness of the earth. For shadows are of three shapes, and it is clear that, if the solid object that throws a shadow is equal in area to the shaft of light, the shadow projected is shaped like a pillar and is of infinite length, but if the solid body is larger than the light, the shadow has the shape of an upright spinning-top, so that it is narrowest at the bottom, and infinite in length as in the former case, while if the solid is smaller than the light the result is the figure of a cone narrowing down to end in a point, and this is the nature of the shadow observed during an eclipse of the moon; hence it is proved without any further possibility of doubt remaining that the sun exceeds the earth's size. Indeed, this is also proved by the silent testimony of nature herself; for why in the division of the turns of the year does the winter sun

abscedit ut noctium opacitate terras reficiat?¹ exustus haut dubie, et sic quoque exurens quadam in parte, tanta magnitudo est.

53 IX. Et rationem quidem defectus utriusque primus Romani generis in vulgum extulit Sulpicius Gallus (qui consul cum M. Marcello fuit, sed tum tribunus militum), sollicitudine exercitu liberato pridie quam Perseus rex superatus a Paulo est in concionem ab imperatore productus ad praedicendam eclipsim; mox et composito volumine. apud Graecos autem investigavit primus omnium Thales Milesius Olympiadis XLVIII anno quarto praedicto solis defectu qui Alyatte rege factus est urbis conditae anno CLXX. post eos utriusque sideris cursum in sexcentos annos praececinuit Hipparchus, menses gentium diesque et horas ac situs locorum et visus populorum complexus, aevo teste haut alio modo
54 quam consiliorum naturae particeps. viri ingentes, supraque mortalium naturam, tantorum numinum lege deprehensa et misera hominum mente metu soluta,² in defectibus siderum scelera aut mortem aliquam pavente (quo in metu fuisse Stesichori et Pindari vatium sublimia ora palam est deliquio solis) aut in lunae veneficia arguente mortalitate et ob id crepitu dissono auxiliante (quo pavore ignarus causae Nicias Atheniensium imperator veritus classem portu

¹ reficiat <aliter>? *Rackham*.

² *Rackham*: mente insoluta, mente absoluta.

^a At Pydna, 168 B.C.

^b Perhaps *situs* denotes latitude and *visus* longitude.

^c Or possibly 'as time has shown.'

^d Pindar, fr. 74 (Bergk²). The passage of Stesichorus is not extant.

retire, so as to refresh the earth with the darkness of the nights? when otherwise it would unquestionably scorch up the earth, and even as it is does so in a certain part, so great is its magnitude.

IX. The first person indeed of Roman nationality who published an explanation of both kinds of eclipse *Eclipses, th. ories as i. o.* was Sulpicius Gallus—the colleague in the consulship of Marcus Marcellus, but at the time military tribune—who delivered the army from fear when on the day before the defeat^a of King Perseus by Paulus he was brought before an assembly by the commander-in-chief to foretell an eclipse; and later also by writing a treatise. The original discovery was made in Greece by Thales of Miletus, who in the fourth year of the 48th Olympiad (585 B.C.) foretold the eclipse of the sun that occurred in the reign of Alyattes, in the 170th year after the foundation of Rome. After their time the courses of both stars for 600 years were prophesied by Hipparchus, whose work embraced the calendar of the nations and the situations of places and aspects of the peoples^b—his method being, on the evidence of his contemporaries,^c none other than full partnership in the designs of nature. O mighty heroes, of loftier than mortal estate, who have discovered the law of those great divinities and released the miserable mind of man from fear, mortality dreading as it did in eclipses of the stars crimes or death of some sort (those sublime singers, the bards Stesichorus and Pindar,^d clearly felt this fear owing to an eclipse of the sun), or in the dying of the moon inferring that she was poisoned and consequently coming to her aid with a noisy clattering of cymbals (this alarm caused the Athenian general Nicias, in his ignorance of the cause, to be afraid to

educere opes eorum adflixit): macti ingenio este, caeli interpretes rerumque naturae capaces, argumenti repertores quo deos hominesque vicistis!
 55 quis enim haec cernens et statos siderum (quoniam ita appellare placuit) labores non suae necessitati mortales genitos agnoscat?

Nunc confessa de iisdem breviter atque capitulatum attingam ratione admodum necessariis locis strictimque reddita, nam neque instituti operis talis argumentatio est, neque omnium rerum afferri posse causas minus mirum est quam constare in aliquis.

56 X. Defectus CCXXIII mensibus redire in suos orbis certum est, solis defectus non nisi novissima primave fieri luna, quod vocant coitum, lunae autem non nisi plena, semperque citra quam proxime fuerint; omnibus autem annis fieri utriusque sideris defectus statis diebus horisque sub terra, nec tamen, cum superne fiant, ubique cerni, aliquando propter
 57 mundi. intra ducentos annos Hipparchi sagacitate conpertum est et lunae defectum aliquando quinto mense a priore fieri, solis vero septimo, eundem bis

* Eclipse of the moon, 27 Aug., 413 B.C., caused Nicias to delay abandoning the siege of Syracuse: Plutarch, *Nicias*, 23.

^b Cf. § 43 n.

^c It is tempting to rewrite this passage—*deos hominesque vicistis!* (so one MS.) *quis enim . . . non sua necessitate* (Rackham) *mortales genitos* (v. l.) *agnoscat* (Dalec.)? ‘—a theory

lead his fleet out of harbour, so destroying the Athenians' resources^a): all hail to your genius, ye that interpret the heavens and grasp the facts of nature, discoverers of a theory whereby you have vanquished gods and men! for who beholding these truths and the regularity of the stars' periods of trouble^b (for so it has pleased you to call them), would not forgive his own destiny for the generation of mortals?^c

Now I will briefly and summarily touch on facts that are admitted about the same matters, giving an account of them only at necessary points and in a cursory manner, because such theorizing does not form part of the task that I have set in hand, and also it is less surprising that explanations cannot be produced for all the facts than that agreement has been reached on some of them.

X. It is certain that eclipses recur in cycles of 223 months—eclipses of the sun only when the moon is in her last or first phase (this is called their ‘conjunction’), eclipses of the moon only at full moon—and always within the period of their last occurrence; but that yearly at fixed days and hours eclipses of either star occur below the earth, and that even when they occur above the earth they are not visible everywhere, sometimes owing to clouds, more often because the earth's globe stands in the way of the world's curvature. Less than 200 years ago the penetration of Hipparchus discovered that an eclipse of the moon also sometimes occurs four months after the one before and an eclipse of the sun six

whereby ye have fettered gods and men! for who would not recognise that mortals are born with a fixed destiny of their own?’

in triginta diebus super terras occultari, sed ab aliis atque aliis¹ hoc cerni, quaeque sunt in hoc miraculo maxime mira, cum conveniat umbra terrae lunam hebetari, nunc ab occasus parte hoc ei accidere, nunc ab exortus, et quanam ratione, cum solis exortu umbra illa hebetatrix sub terra esse debeat, semel iam acciderit ut in occasu luna deficeret utroque super terram conspicuo sidere. nam ut XV diebus utrumque sidus quaereretur et nostro aevo accidit imperatoribus Vespasianis patre III. filio iterum consulibus.

58 XI. Lunam semper aversis a sole cornibus, si crescat, ortus spectare, si minuatur, occasus, haut dubium est, et² lucere dodrantes semuncias horarum ab secunda adicientem usque ad plenum orbem detrahentemque in deminutionem, intra quattuordecim autem partes solis semper occultam esse. quo argumento amplior errantium stellarum quam lunae magnitudo colligitur, quando illae et a septenis interdum partibus emergant; sed altitudo cogit minores videri, sicut adfixas caelo solis fulgor interdiu non cerni, cum aequae ac noctu luceant, idque manifestum fiat defectu solis et praealtis puteis.

59 XII. Errantium autem tres quas supra solem diximus sitas occultantur meantes cum eo, exoriuntur

¹ *v.l. om. atque aliis.*

² *et add. Ruckham.*

^a I.e. one eclipse to the inhabitants of the northern hemisphere, the other to those of the southern.

^b A.D. 71.

months, and that the latter when above earth is hidden twice in thirty days, but that this eclipse is visible to different nations,^a and—the most remarkable features of this remarkable occurrence—that when it comes about that the moon is obscured by the shadow of the earth, this sometimes happens to it from the west side and sometimes from the east; and he also discovered for what exact reason, although the shadow causing the eclipse must from sunrise onward be below the earth, it happened once in the past that the moon was eclipsed in the west while both luminaries were visible above the earth. For the eclipse of both sun and moon within 15 days of each other has occurred even in our time, in the year of the third consulship of the elder Emperor Vespasian and the second consulship of the younger.^b

XI. It is unquestionable that the moon's horns The moon's phases. are always turned away from the sun, and that when waxing she faces east and when waning west; and that the moon shines $47\frac{1}{2}$ minutes longer^c daily from the day after new moon to full and $47\frac{1}{2}$ minutes less daily to her wane, while within 14 degrees of the sun she is always invisible. This fact proves that the planets are of greater magnitude than the moon, since these occasionally become visible even on reaching 7 degrees' distance; but their altitude makes them appear smaller, just as the sun's radiance makes the fixed stars invisible in daytime, although they are shining as much as in the night, which becomes manifest at a solar eclipse and also when the star is reflected in a very deep well.

XII. The three planets whose positions we have The planets. their motions and occultation stated to be above the sun travel with the sun when

^c I.e. rises $47\frac{1}{2}$ minutes earlier.

vero a¹ matutino discedentes partibus numquam amplius undenis. postea a² radiorum eius contactu regrediuntur,³ et in triquetro a partibus centum viginti stationes matutinas faciunt, quae et primae vocantur, mox in⁴ adverso a partibus centum octoginta exortus vespertinos, iterumque in centum viginti ab alio latere appropinquantes stationes vespertinas quas et secundas vocant, donec assecutus sol in partibus duodenis occultet illas, qui vespertini
 60 occasus appellantur. Martis stella ut propior etiam ex quadrato sentit radios, a nonaginta partibus, unde et nomen accepit motus primus et secundus nonagenarius dictus ab utroque exortu. eadem stationalis senis mensibus conmoratur in signis, alioqui
 61 bimestris, cum ceterae utraque statione quaternos menses non impleant. inferiores autem duae occultantur in coitu vespertino simili modo, relictæque a sole totidem in partibus faciunt exortus matutinos, atque a longissimis distantiae suae metis solem insecuntur, adeptæque occasu matutino conduntur ac praetereunt. mox eodem intervallo vespere exoriuntur usque ad quos diximus terminos. ab his retrogradiuntur ad solem et occasu vespertino delitescunt. Veneris stella et stationes duas, matutinam vespertinamque, ab utroque exortu facit a

¹ a *add. Rackham.*

² a *add. Rackham.*

³ *Brotier* : reguntur aut teguntur.

⁴ in *v.l. om* : ex ? *Rackham.*

they set and are never more than 11 degrees separate from the sun at dawn when they rise. Afterwards they retire from contact with his rays, and make their morning or 'first' stations in a triangle 120 degrees away, and subsequently their evening risings opposite 180 degrees away, and again approaching from the other side, make their evening or 'second' stations 120 degrees away, till the sun overtaking them at 12 degrees obscures them—this is called their evening setting. The planet Mars being nearer feels the sun's rays even from its quadrature, at an angle of 90 degrees, which has given to his motion after each rising the name of 'first' or 'second ninety-degree.' At the same time Mars remains stationary in the signs of the zodiac for periods of six months (otherwise having a two-month period), whereas Jupiter and Saturn spend less than four months in each station.^a The two lower planets (Mercury and Venus) are similarly obscured at their evening conjunction, and when left by the sun make their morning rising the same number of degrees away, and from the further limits of their distance follow the sun and when they have overtaken him are hidden in their morning setting and pass away. Then they rise in the evening at the same distance apart, as far as the limits we have stated. From these they pass backward to the sun, and disappear in their evening setting. The planet Venus actually makes two stations, morning and evening, after each rise, from the furthest

^a *Brotier* : Martis stella proprio cursu bimestris est, hoc est duobus mensibus signum unum pervagatur, binis ferme annis duodena (cf. 34). Eadem ab una statione ad alteram menses senos insumit : ceterae, Jovis et Saturni, vix quaternos.

longissimis distantiae suae finibus. Mercurii stationes breviora momento quam ut deprehendi possint.

62 XIII. Haec est luminum occultationumque ratio, perplexior motu multisque involuta miraculis, siquidem magnitudines suas et colores mutant, et eadem ad septentrionem accedunt abeuntque ad austrum, terrisque propiores aut caelo repente cernuntur. in quibus aliter multa quam priores tradituri fatemur ea quoque illorum esse muneris qui primi quaerendi vias demonstraverint, modo ne quis desperet saecula proficere semper.

63 Pluribus de causis haec omnia accidunt. prima circulorum quos Graeci ἀψίδας in stellis vocant (etenim Graecis utendum erit vocabulis). sunt autem hi suus¹ cuique earum, aliique quam mundo, quoniam terra a verticibus duobus quos appellaverunt polos centrum caeli est, nec non et signiferi oblique inter eos siti. [omnia autem haec constant ratione circini semper indubitata.]² ergo ab alio cuique centro apsides suae exsurgunt, ideoque diversos habent orbis motusque dissimiles, quoniam interiores apsidas necesse est breviores esse.

64 Igitur a terrae centro apsides altissimae sunt Saturno in scorpione, Iovi in virgine, Marti in leone, soli in geminis, Veneri in sagittario, Mercurio in

¹ *Rackham*: sui.

² *Secl. edd.*

^a Editors reject this as an interpolation.

limits of her distance. Mercury's stations have too short a period to be perceptible.

XIII. This is the system of the shining and occultation of the planets: it is more complicated from their motion and involves many remarkable facts, inasmuch as they change their magnitude and their colours, and both approach the North and retire towards the South, and suddenly are seen closer to the earth or to the sky. And although our account of these matters will differ in many points from that of our predecessors, we confess that credit for these points also must be given to those who first demonstrated the methods of investigating them: only nobody must abandon the hope that the generations are constantly making progress.

All these occurrences are due to a plurality of ^{due to three causes.} causes. The first is the factor of the circles which in the case of the stars the Greeks designate *apsides* or arcs (it will be necessary to employ Greek terms). Each planet has its own circle, and these are not the same as those of the firmament, since the earth between the two vertices, named in Greek *poles*, is the centre of the sky, and also of the zodiac, which is situated on a slant between the poles. [All these facts are always established beyond doubt by the method of compasses.^a] Therefore the special arc of each is drawn from a different centre, and consequently they have different orbits and dissimilar motions, because the inner arcs must necessarily be shorter.

It follows that the points of the arcs highest above the centre of the earth are: in the case of Saturn in Scorpio, in that of Jupiter in Virgo, of Mars in Leo, of the sun in the Twins, of Venus in the Archer,

capricorno, lunae in tauro,¹ mediis omnium partibus, et e contrario humillimae atque ad terrae centrum² proximae. sic fit ut tardius moveri et minores videantur cum altissimo ambitu feruntur, cum vero terrae appropinquaverint maiores esse et celerius ferri, non quia adcelerent tardentve naturales motus, qui certi ac singuli sunt illis, sed quia deductas ab summa apside lineas coarctari ad centrum necesse est sicut in rotis radios, idemque motus alias maior alias minor centri propinquitate sentitur.

65 Altera sublimitatum causa quoniam a suo centro apsidas altissimas habent in aliis signis, Saturnus in librae parte vicesima, Iuppiter cancri quinta decuma, Mars capricorni XXVIII, sol arietis XXIX, Venus piscium XXVII, Mercurius virginis XV, luna tauri IV.

Tertia altitudinum ratio caeli mensura, non circuli, intellegitur, subire eas aut descendere per profundum aeris oculis aestimantibus.

66 Huic conexas latitudinum signiferi obliquitatisque causa est. per hunc stellae quas diximus feruntur, nec aliud habitatur in terris quam quod illi subiacet, reliqua a polis squalent. Veneris tantum stella excedit eum binis partibus, quae causa intellegitur efficere ut quaedam animalia et in desertis mundi nascantur. lunam quoque per totam latitudinem eius

¹ *Deilefsen e Beda.*

² *Rackham*: ad terrae centrum ante humillimae.

^a The planets, § 30 fin.

of Mercury in Capricorn, of the moon in the Bull, at the middle of each, and the points lowest and nearest to the centre of the earth are opposite. The result of this is that they appear to move slower and to be smaller when they are travelling at the highest point of their circuit, but to be larger and travel faster when they have come nearer to the earth, not because they actually accelerate or reduce their natural motions, which are fixed and individual to them, but because lines drawn from the top of the arc to the centre necessarily converge like the spokes of a wheel, and the same motion at one time is perceived as faster and at another slower according to its distance from the centre.

Another reason of their elevations is because they have the points of their arcs highest from their centre in different signs—Saturn in the 20th degree of the Scales, Jupiter in the 15th of the Crab, Mars in the 28th of Capricorn, the sun in the 29th of the Ram, Venus in the 27th of the Fishes, Mercury in the 15th of Virgo, the moon in the 4th of the Bull.

A third explanation of their altitudes is explained by the dimensions of the firmament, not that of a circle, the eye judging them to rise or to sink through the depth of the air.

Linked with this is the cause of the latitudes of the zodiac and of its obliquity. The stars we have mentioned^a travel through the zodiac, and the only habitable part of the earth is what lies beneath it—all the other parts towards the poles are frost-bound. Only the planet Venus goes two degrees outside the zodiac; this is understood to be the reason that causes some animals to be born even in the desert places of the world. The moon also wanders through

Orbits of the planets (1) in relation to the zodiac;

- vagatur, sed omnino non excedens eum. ab his Mercuri stella laxissime, ut tamen e duodenis partibus (tot enim sunt latitudinis) non amplius octonas pererret, neque has aequaliter, sed duas
- 67 medio eius et supra quattuor infra duas. sol deinde medio fertur inter duas partes flexuoso draconum meatu inaequalis, Martis stella quattuor mediis, Iovis media et super eam duabus, Saturni duabus ut sol. haec erit latitudinum ratio ad austrum descendentium aut ad aquilonem subeuntium. hac constare et tertiam illam a terra subeuntium in caelum, et pariter scandi eam quoque existimavere plerique falso. qui ut coarguantur, aperienda est subtilitas immensa et omnes eas complexa causas.
- 68 Convenit stellas in occasu vespertino proximas esse terrae et altitudine et latitudine, exortusque matutinos in initio cuiusque fieri, stationes in mediis latitudinum articulis, quae vocant ecliptica. perinde confessum est motum augeri quamdiu in vicino sint terrae, cum abscedant in altitudinem, minui; quae ratio lunae maxime sublimitatibus adprobatur. aequae non est dubium in exortibus matutinis etiamnum augere atque a stationibus primis tres superiores
- 69 diminuere usque ad stationes secundas. quae cum ita sint, manifestum erit ab exortu matutino lati-

the whole of its breadth, but without going at all outside it. The planet Mercury diverges very widely from these, but without wandering over more than 8 of the 12 degrees of latitude of the zodiac, and these 8 not uniformly but two in the middle of the zodiac, four above it and two below it. Then the sun travels unevenly in the middle of the zodiac between the two halves with a wavy serpentine course, the planet Mars over 4 degrees in the middle, Jupiter one in the middle and two above it, Saturn two like the sun. This will be the principle of the latitudes of the planets when setting towards the South or rising towards the North. Most people have supposed that with this system agrees also the third mentioned above,^a that of their rising from the earth to the sky, and that this ascent also is made simultaneously; but this is a mistake. To refute them it is necessary to develop an extremely abstruse argument that embraces all the causes mentioned.

It is agreed^b that the planets are nearest to the earth^{(2) in relation to the earth.} in both altitude and latitude at their evening setting, and that their morning risings occur at the beginning of both altitude and latitude, while their stations occur in the middle sections of the altitudes, called 'ecliptics.' It is similarly admitted^c that their velocity increases as long as they are in the neighbourhood of the earth and decreases when they withdraw from it to a height: this theory is specially supported by the apogees of the moon. It is equally undoubted^d that the three higher ones^e moreover increase their motion in their morning risings and diminish it from their first (morning) stations to their second (evening) stations. In view of these facts it will be evident that the latitudes are ascended from

^a § 65 fin.

^c *Secunda ratio*, § 65.

^b *Prima ratio*, § 63.

^d *Tertia ratio*, § 65 fin.

^e See § 71 fin.

tudines scandi quoniam in eo primum habitu incipiat parcius adici motus, in stationibus vero primis et altitudinem subiri, quoniam tum primum incipient detrahi numeri¹ stellaeque retroire. cuius rei ratio privatim reddenda est. percussae in qua diximus parte et triangulo solis radio inhibentur rectum
 70 agere cursum, et ignea vi levantur in sublime. hoc non protinus intellegi potest visu nostro, ideoque existimantur stare, unde et nomen accepit statio. progreditur deinde eiusdem radii violentia et retroire cogit vapore percussas. multo id magis in vespertino earum exortu, toto sole adverso² cum in summas apsidas expelluntur, minimaque cernuntur quoniam altissime absunt et minimo feruntur motu, tanto minore³ cum hoc in altissimis apsidum evenit signis.
 71 ab exortu vespertino latitudo descenditur parcius iam se minuente motu, non tamen ante stationes secundas augente, cum et altitudo descenditur, superveniente ab alio latere radio eademque vi rursus ad terras deprimente qua sustulerat in caelum e priore triquetro. tantum interest subeant radii an superveniant, multoque eadem magis in vespertino occasu accidunt.

Haec est superiorum stellarum ratio; difficilior reliquarum et a nullo ante nos reddita.

¹ *v.l.* incipiat . . . numerus.

² *v.l.* auerso.

³ *v.l.* minores.

their morning rising, because in that state their acceleration first begins to diminish, but in their first stations their altitude also is ascended, since then the numbers first begin to be reduced and the stars begin to recede. The reason for this must especially be given. When struck in the degree that we stated and by a triangular ray of the sun they are prevented from pursuing a straight course, and are lifted upward by the fiery force. This cannot be directly perceived by our sight, and therefore they are thought to be stationary, which has given rise to the term 'station.' Then the violent force of the same ray advances and compels them by the impact of the heat to retire. This occurs much more at their evening rising, when they are driven out to the top of their apsides by the full opposing force of the sun, and appear very small because they are at the distance of their greatest altitude and are moving with their smallest velocity—which is proportionately smaller when this occurs in the highest signs of their apsides. From their evening rise their altitude is descended with a velocity now decelerating less and less, but not accelerating before their second stations, when their altitude also is descended, the ray passing above them from the other side and pressing them down again to the earth with the same force as that with which it had raised them to the sky from the former triangle. So much difference does it make whether the rays come from below or from above, and the same things occur far more in the evening setting.

This is the theory of the higher stars; that of the rest is more difficult and has been explained by nobody before ourselves.

- 72 XIV. Primum igitur dicatur, cur Veneris stella numquam longius XLVI partibus, Mercurii XXIII ab sole abscedant, saepe citra eas ad solem reciprocant. conversas habent utraeque apsidas ut infra solem sitae, tantumque circuli earum sub terra est quantum superne praedictarum; et ideo non possunt abesse amplius quoniam curvatura apsidum ibi non habet longitudinem maiorem: ergo utrique simili ratione modum statuunt apsidum suarum margines, ac spatia longitudinis latitudinum evagatione pensant. at enim cur non semper ad quadraginta sex et ad partes viginti tres perveniunt? immo vero; sed ratio canonicos fallit. namque apparet apsidas quoque earum moveri, quod numquam transeant solem; itaque cum in partem ipsam eius incidere margines alterutro latere, tum et stellae ad longissima sua intervalla pervenisse¹ intelleguntur: cum citra fuere margines, totidem partibus et ipsae ocius redire coguntur, cum sit illa semper utrique extremitas summa.
- 74 Hinc et ratio motuum conversa intellegitur. superiores enim celerrime feruntur in occasu vespertino, hae tardissime, illae a terra altissime absunt cum tardissime moventur, hae cum ocissime, quia

¹ *Rackham*: pervenire.

XIV. First therefore let us state the reason why Venus never departs more than 46 degrees and Mercury never more than 23 degrees from the sun, and why they often retire and return towards the sun within those limits. As situated below the sun both have arcs that are the opposite of those of the other planets, and as much of their circle is below the earth as that of the planets mentioned before is above it; and they cannot be further from it than they are because the curve of their arcs does not allow greater elongation there; consequently the edges of their arcs put a limit on a similar principle for each, and compensate for the dimensions of their longitude by the enlargement of their latitude. But, it will be objected, why do they not reach 46 and 23 degrees always? As a matter of fact they do, but the explanation escapes the theorists. For it is manifest that even their arcs alter, because they never cross the sun; accordingly when the edges have fallen on one side or the other into the actual degree of the sun, then the stars also are understood to have reached their longest distances, but when the edges are short of that, they themselves too are compelled to return with proportionately greater velocity, since with each of them that is always the extreme limit.

This also explains the contrary principle of their motions. For the higher planets travel most quickly in their evening setting, whereas these travel most slowly, and the former are farthest from the earth when their pace is slowest but the latter are highest when their pace is quickest—the reason being that with the latter the circumference of the circle accelerates their pace in the same manner as

Orbits of Venus and Mercury.

sicut in illis propinquitas centri adcelerat ita in his extremitas circuli, illae ab exortu matutino minuere celeritatem incipiunt, hae vero augere. illae retro cursum agunt a statione matutina usque ad vespertinam, Veneris a vespertina usque ad matutinam.

75 incipit autem ab exortu matutino latitudinem scandere, altitudinem vero subire ¹ ac solem insequi a statione matutina, ocissima in occasu matutino et altissima, degredi autem latitudine motumque minuere ab exortu vespertino, retro quidem ire simulque altitudine degredi a statione vespertina; Mercurii rursus stella utroque modo scandere ab exortu matutino, degredi vero latitudine a vespertino, consecutoque sole ad quindecim partium intervallum

76 consistit quatrinduo prope immobilis. mox ab altitudine descendit retroque graditur ab occasu vespertino usque ad exortum matutinum. tantumque haec et luna totidem diebus quot subiere descendunt; Veneris quindecies pluribus subit, rursus Saturni et Iovis duplicato degrediuntur, Martis etiam quadruplicato. tanta est naturae varietas; sed ratio evidens: nam quae in vaporem solis nituntur etiam descendunt aegre.

77 XV. Multa promi amplius circa haec possunt secreta naturae legesque quibus ipsa serviat, exempli gratia in Martis sidere (cuius est maxime inobservabilis cursus) numquam id stationem facere Iovis sidere triquetra, raro admodum sexaginta partibus discreto (qui numerus sexangulas mundi efficit

¹ subire add. *Urlichs.*

proximity to the centre does in the case of the former; the former begin to decelerate from their morning setting, but the latter to accelerate. The former travel backward from their morning to their evening station, the planet Venus from her evening to her morning station. But she begins to climb her latitude after her morning rise, but after her morning station to ascend her altitude and follow the sun, being swiftest and highest at her morning setting; whereas she begins to descend in latitude and decelerate after her evening rising, and to turn back and simultaneously to descend in altitude after her evening station; on the other hand the planet Mercury begins to climb in both ways after his morning rising, but after his evening rising to descend in latitude, and following the sun at an interval of 15 degrees he stands motionless for almost four days. Afterwards he descends from his altitude and proceeds back from his evening setting to his morning rise. And only this planet and the moon set in as many days as they have risen in; Venus ascends in 15 times as many days as she sets in, while Saturn and Jupiter descend in twice as many, and Mars in actually four times as many. So great is the variety of nature; but the reason is evident—bodies that strain up into the heat of the sun also have difficulty in descending.

XV. Many more facts can be produced about these mysteries of nature and the laws that she obeys—for example, in the case of the planet Mars (whose course it is very difficult to observe) that it never makes its station with Jupiter at an angle of 120°, and very seldom with Jupiter separated 60° (which amounts to $\frac{1}{8}$ th of the celestial

Other relations of particular planets to the zodiac.

formas,¹⁾ nec exortus nisi in duobus signis tantum, cancri et leonis, simul edere, Mercuri vero sidus exortus vespertinos in piscibus raros facere, creberrimos in virgine, in libra matutinos, item matutinos in aquario, rarissimos in leone, retrogradum in tauro et in geminis non fieri, in cancro vero non citra vice-
 78 simam quintam partem, lunam bis coitum cum sole in nullo alio signo facere quam geminis, non coire aliquando in sagittario tantum, novissimam vero primamque eadem die vel nocte nullo alio in signo quam ariete conspici (id quoque paucis mortalium contigit, et inde fama cernendi Lynceo), non comparere in caelo Saturni sidus et Martis cum plurimum diebus centum septuaginta, Iovis triginta sex, aut cum minimum denis detractis diebus omnia, Veneris sexaginta novem aut cum minimum quinquaginta duobus, Mercuri tredecim aut cum plurimum septemdecim.

79 XVI. Colores ratio altitudinum temperat, siquidem earum similitudinem trahunt in quarum aera venere subeundo, tinguitque adpropinquantes utralibet alieni meatus circulus, frigidior in pallorem, ardentior in ruborem, ventosus in livorem,² sol atque commissurae apsidum, extremaeque orbitae, atram in obscuritatem. suos quidem cuique color est, Saturno candidus, Iovi clarus, Marti igneus, Lucifero candens, Vesperi refulgens, Mercurio radians, lunae blandus, soli cum oritur ardens, post

¹ [qui . . . formas]? *Rackham*.

² *Mayhoff*: horrorem aut honorem.

^a Literally 'which number produces the hexagonal shapes of the world'—apparently meaning that to draw in a circle 6 radii at angles of 60° and join the points where they reach the circumference produces a regular hexagon. Even if we

sphere ^a), and never makes its rises simultaneously with Jupiter except in two signs only, Cancer and Leo, whereas the planet Mercury rarely makes its evening rises in Pisces, and most frequently in Virgo, its morning rises in Libra, and also its morning rises in Aquarius, very rarely in Leo; it does not make its return in Taurus and in Gemini, and not below the 25th degree in Cancer; Gemini is the only sign in which the moon makes conjunction with the sun twice, Sagittarius the only one in which she does not meet him at all, Aries the only one in which the old moon and the new moon are visible on the same day or night (and this too it has happened to few mortals to see, hence Lynceus's reputation for keen sight); the longest period of invisibility for the planets Saturn and Mars is 170 days, for Jupiter 36 days; the shortest periods for all these are 10 days less; Venus's period is 69 days or at shortest 52, Mercury's 13 or at longest 17.

XVI. The colours of the planets vary with their altitudes, inasmuch as they are assimilated to the stars into whose atmosphere they come in rising, and the circuit of another's path modifies their colour in either direction as they approach, a colder circuit to pallor, a hotter one to redness, a windy one to a leaden colour, the sun and the intersection of its orbit with theirs, and also the extremities of their paths, changing them to black darkness. It is true that each has its own special hue—Saturn white, Jupiter transparent, Mars fiery, Lucifer bright white, Vesper glaring, Mercury radiant, the moon soft, the sun when rising glowing and
Colours of the planets.
 emend *sexangulas formas* to the singular, this clumsily expressed piece of geometry looks like an interpolation.

80 radians, his causis conexo visu et earum¹ quae caelo continentur. namque modo multitudo conferta inest circa dimidios orbes lunae, placida nocte leniter inlustrante eas, modo raritas, ut fugisse miremur, plenilunio abscondente aut cum solis suprave dictarum radii visus praestrinxere nostros. et ipsa autem luna ingruentium solis radiorum haut dubie differentias sentit, hebetante cetero inflexos mundi convexitate eos praeterquam ubi recti angulorum competant ictus. itaque in quadrato solis dividua est, in triquetro seminani ambitur orbe, inpletur autem in adverso, rursusque minuens easdem effigies paribus edit intervallis, simili ratione qua super solem tria sidera.

81 XVII. Sol autem ipse quattuor differentias habet, bis aequata nocte diei, vere et autumno, in centrum incidens terrae octavis in partibus arietis ac librae, bis permutatis spatiis, in auctum diei bruma octava in parte capricorni, noctis vero solstitio totidem in partibus cancri. inaequalitatis causa obliquitas signiferi cum pars aequa mundi super subterque terras omnibus fiat momentis; sed quae recta in exortu suo consurgunt signa longiore tractu tenent lucem, quae vero obliqua ociore transeunt spatio.

82 XVIII. Latet plerosque magna caeli adsectatione conpertum a principibus doctrinae viris superiorum

¹ visu ceterarum *Brotier*.

^a The Etruscans, c. lii.

afterwards radiant; with these being causally connected also the appearance of the fixed stars. For at one time there is a dense crowd of stars in the sky round the circle of the half-moon, a fine night giving them a gentle radiance, but at another time they are scarce, so that we wonder at their flight, when the full moon hides them or when the rays of the sun or the planets above-mentioned dim our sight. But the moon herself also is undoubtedly sensitive to the variations of the strength of impact of the rays of the sun, as moreover the curve of the earth dulls their impact, except when the impact of the rays meets at a right angle. And so the moon is at half in the sun's quadrature, and curved in a hollow circle in its trinal aspect, but waxes to full at the sun's opposition, and then waning exhibits the same configurations at corresponding intervals, on the same principle as the three planets above the sun.

XVII. The sun itself has four differences, as there are two equinoxes, in spring and autumn, when it coincides with the centre of the earth at the eighth degree of Aries and Libra, and two changes of its course, in the eighth degree of Capricorn at mid-winter when the days begin to lengthen and in the same degree of Cancer at the summer solstice. The variation is due to the slant of the zodiac, as at every moment an equal part of the firmament is above and below the earth; but the planets that follow a straight path at their rising keep their light for a longer tract and those that follow a slanting path pass in a swifter period.

XVIII. Most men are not acquainted with a truth known to the founders^a of the science from their

The sun's differences

Thunderbolts from three planets.

trium siderum ignes esse qui decidui ad terras fulminum nomen habeant, sed maxime Iovis¹ medio loco siti, fortassis quoniam contagium nimii umoris ex superiore circulo atque ardoris ex subiecto per hunc modum egerat, ideoque dictum Iovem fulmina iaculari. ergo ut e flagrante ligno carbo cum crepitu, sic a sidere caelestis ignis expuitur praescita secum adferens, ne abdicata quidem sui parte in divinis cessante operibus. idque maxime turbato fit aeres quia collectus umor abundantiam stimulat aut quia turbatur quodam ceu gravidis sideris partu.

83 XIX. Intervalla quoque siderum a terra multi indagare temptarunt, et solem abesse a luna undeviginti partes quantam lunam ipsam a terra prodiderunt. Pythagoras vero, vir sagacis animi, a terra ad lunam CXXVI milia stadiorum esse collegit, ad solem ab ea duplum, inde ad duodecim signa triplicatum, in qua sententia et Gallus Sulpicius fuit noster.

84 XX. Sed Pythagoras interdum ex musica ratione appellat tonum quantum absit a terra luna, ab ea ad Mercurium dimidium eius spatii, et ab eo ad Venerem tantundem, a qua ad solem sescuplum, a sole ad Martem tonum, id est quantum ad lunam a terra,²

¹ *Mayhoff*: *codd.* is, his, extis.

² [id est . . . terra]? *Mayhoff*.

* A stade roughly equals a furlong.

arduous study of the heavens, that what when they fall to earth are termed thunderbolts are the fires of the three upper planets, particularly those of Jupiter, which is in the middle position—possibly because it voids in this way the charge of excessive moisture from the upper circle (of Saturn) and of excessive heat from the circle below (of Mars); and that this is the origin of the myth that thunderbolts are the javelins hurled by Jupiter. Consequently heavenly fire is spit forth by the planet as crackling charcoal flies from a burning log, bringing prophecies with it, as even the part of himself that he discards does not cease to function in its divine tasks. And this is accompanied by a very great disturbance of the air, because moisture collected causes an overflow, or because it is disturbed by the birth-pangs so to speak of the planet in travail.

XIX. Many people have also tried to discover the distances of the planets from the earth, and have given out that the distance of the sun from the moon is 19 times that of the moon itself from the earth. The penetrating genius of Pythagoras, however, inferred that the distance of the moon from the earth was 15,750 miles,^a and that of the sun from the moon twice that figure, and of the sun from the twelve signs of the Zodiac three times. Our fellow-countryman Sulpicius Gallus also held this view.

XX. But occasionally Pythagoras draws on the theory of music, and designates the distance between the earth and the moon as a whole tone, that between the moon and Mercury a semitone, between Mercury and Venus the same, between her and the sun a tone and a half, between the sun and Mars a tone (the same as the distance between the earth and the

Distances of the planets.

Their harmonic ratio.

ab eo ad Iovem dimidium, et ab eo ad Saturnum dimidium, et inde sescuplum ad signiferum; ita septem tonis effici quam diapason harmoniam vocant, hoc est universitatem concentus; in ea Saturnum Dorio moveri phthongo, Iovem Phrygio, et in reliquis similia, iucunda magis quam necessaria subtilitate.

85 XXI. Stadium centum viginti quinque nostros efficit passus, hoc est pedes sexcentos viginti quinque. Posidonius non minus quadraginta stadiorum a terra altitudinem esse in quam nubila ac venti nubesque perveniant, inde purum liquidumque et inperturbatae lucis aera, sed a turbido ad lunam viciens centum milia stadiorum, inde ad solem quinquiens miliens, eo spatio fieri ut tam inmensa eius magnitudo non exurat terras. plures autem nubes nongentis in altitudinem subire prodiderunt. inconperta haec et inextricabilia, sed prodenda quia sunt prodita, in quis tamen una ratio geometricae collectionis numquam fallacis possit non repudiari, si cui libeat altius ista persequi, nec ut mensura (id enim velle paene dementis otii est) sed ut tantum aestumatio

86 coniectandi constet animo. nam cum trecentis sexaginta et fere sex partibus circulum per quem meat orbis solis ex circuitu eius patere appareat, semperque dimetiens tertiam partem ambitus et tertiae paulo minus septimam colligat, apparet, dempta eius

^a Ἀρμονία διὰ πασῶν τῶν χορδῶν (all the notes in the scale played successively, not a harmony in the modern sense.)

^b See p. 296 note.

moon), between Mars and Jupiter half a tone, between Jupiter and Saturn half a tone, between Saturn and the zodiac a tone and a half: the seven tones thus producing the so-called diapason,^a i.e. a universal harmony; in this Saturn moves in the Dorian mode, Jupiter in the Phrygian, and similarly with the other planets—a refinement more entertaining than convincing.

XXI. A stade is equivalent to 125 Roman paces,^b that is 625 feet. Posidonius holds that mists and winds and clouds reach to a height of not less than 5 miles from the earth, but that from that point the air is clear and liquid and perfectly luminous, but that the distance between the cloudy air and the moon is 250,000 miles and between the moon and the sun 625,000 miles, it being due to this distance that the sun's vast magnitude does not burn up the earth. The majority of writers, however, have stated that the clouds rise to a height of 111 miles. These figures are really unascertained and impossible to disentangle, but it is proper to put them forward because they have been put forward already, although they are matters in which the method of geometrical inference, which never misleads, is the only method that it is possible not to reject, were anybody desirous of pursuing such questions more deeply, and with the intention of establishing not precise measurement (for to aspire to that would mark an almost insane absorption in study) but merely a conjectural calculation. For since it appears from the sun's revolution that the circle through which its orb travels extends nearly 366 degrees, and since the diameter of a circle always measures a little less than $\frac{1}{3} + \frac{1}{21}$ of the circumference, it appears that, as

^b Height of the clouds.

^b Distance of sun, moon and sky.

dimidia quoniam terra centralis interveniat, sextam fere partem huius immensi spatii quod circa terram circuli solaris animo comprehenditur inesse altitudinis spatium, lunae vero duodecimam, quoniam tanto brevius quam sol ambitu currit; ita fieri eam in

87 medio solis ac terrae. mirum quo precedat improbitas cordis humani parvulo aliquo invitata successu, sicut in supra dictis occasionem impudentiae ratio largitur. ausique divinare solis ad terram spatia eadem ad caelum agunt, quoniam sit medius sol, ut protinus mundi quoque ipsius mensura veniat ad digitos. quantas enim dimetiens habeat septimas, tantas habere circulum duo et vicesimas, tamquam plane a perpendiculari mensura caeli constet.

88 Aegyptia ratio, quam Petosiris et Nechepsos ostendere, singulas partes in lunari circulo (ut dictum est) minimo triginta tribus stadiis paulo amplius patere colligit, in Saturni amplissimo duplum, in solis, quem medium esse diximus, utriusque mensurae dimidium. quae computatio plurimum habet pudoris, quoniam ad Saturni circulum addito signiferi ipsius intervallo nec numerabilis multiplicatio efficitur.

89 XXII. Restant pauca de mundo. namque et in ipso caelo stellae repente nascuntur. plura earum genera. cometas Graeci vocant, nostri crinitas

half the circle is subtracted by the interposition of the earth at the centre, the measure of the sun's altitude comprises about $\frac{1}{6}$ th of this conjecturally estimated immense space of the solar circle round the earth, and the moon's altitude $\frac{1}{12}$ th, since the moon runs in a circuit that is much shorter than the sun's; so that it comes between the sun and the earth. It is marvellous to what length the depravity of man's intellect will go when lured on by some trifling success, in the way in which reason furnishes impudence with its opportunity in the case of the calculations above stated. And when they have dared to guess the distances of the sun from the earth they apply the same figures to the sky, on the ground that the sun is at its centre, with the consequence that they have at their finger's ends the dimensions of the world also. For they argue that the circumference of a circle is $\frac{22}{7}$ times its diameter, as though the measure of the heavens were merely regulated from a plumb-line! The Egyptian calculation published by Petosiris and Nechepsos infers that one degree of the lunar circle measures (as has been said) just over $4\frac{1}{8}$ miles at the least, one degree of the widest circle, Saturn's, twice that size, and one of the sun's circle, which we stated to be in the middle, the mean between the other two. This computation is a most shameful business, since the addition of the distance of the zodiac itself to the circle of Saturn produces a multiple that is even beyond reckoning.

XXII. A few facts about the world remain. There are also stars that suddenly come to birth in the heaven itself; of these there are several kinds. The Greeks call them 'comets,' in our language 'long-haired stars,' because they have a blood-red

*Comets,
varieties of.*

horrentis crine sanguineo et comarum modo in vertice hispidas. iidem pogonias quibus inferiore ex parte in speciem barbae longae promittitur iuba. acontiae iaculi modo vibrantur, atrocissimo significatu; haec fuit de qua quinto consulatu suo Titus Imperator Caesar praeclaro carmine perscripsit, ad hunc diem novissime visa. easdem breviores et in mucronem fastigatas xiphias vocavere, quae sunt omnium pallidissimae et quodam gladii nitore ac sine ullis radiis, quos et disceus, specie¹ nomini similis, colore autem
 90 electro, raros e margine emittit. pitheus doliorum cernitur figura in concavo fumidae lucis. ceratias cornus speciem habet, qualis fuit cum Graecia apud Salamina depugnavit. lampadias ardentes imitatur faces, hippeus equinas iubas celerrimi motus atque in orbem circa se euntes. fit et candidus² cometes argenteo crine ita refulgens ut vix contueri liceat, specieque humanae faciei³ effigiem in se ostendens. fiunt et hirci⁴ villorum specie et nube aliqua circumdati. semel adhuc iubae effigies mutata in hastam est, Olympiade CVIII,⁵ urbis anno CCCCVIII.⁶

¹ specie add. *Deilefsen*.

² candidus <Διός> *Mayhoff*, cf. *Lydus*, p. 163.

³ *Mayhoff*: humana diei aut dei.

⁴ v.l. hirti. ⁵ v.l. CIX, CV.

⁶ *Edd.*: CCCXCVIII.

^a The title seems to have become an hereditary surname. Titus's 5th consulship was in A.D. 76, his colleague being Vespasian in his 7th consulship.

^b Perhaps to be emended 'a shining comet called Zeus's Comet.'

shock of what looks like shaggy hair at their top. The Greeks also give the name of 'bearded stars' to those from whose lower part spreads a mane resembling a long beard. 'Javelin-stars' quiver like a dart; these are a very terrible portent. To this class belongs the comet about which Titus Imperator^a Caesar in his 5th consulship wrote an account in his famous poem, that being its latest appearance down to the present day. The same stars when shorter and sloping to a point have been called 'Daggers'; these are the palest of all in colour, and have a gleam like the flash of a sword, and no rays, which even the Quoit-star, which resembles its name in appearance but is in colour like amber, emits in scattered form from its edge. The 'Tub-star' presents the shape of a cask, with a smoky light all round it. The 'Horned star' has the shape of a horn, like the one that appeared when Greece fought the decisive battle of Salamis. The 'Torch-star' resembles glowing torches, the 'Horse-star' horses' manes in very rapid motion and revolving in a circle. There also occurs a shining comet^b whose silvery tresses glow so brightly that it is scarcely possible to look at it, and which displays within it a shape in the likeness of a man's countenance. There also occur 'Goat comets,' enringed with a sort of cloud resembling tufts of hair. Once hitherto it has happened that a 'Mane-shaped' comet^c changed into a spear; this was in the 108th^a Olympiad, A.U.C. 408.^e The shortest period of

^a Apparently the same as hippeus, the Horse-star, above.

^d 348-345 B.C. Variant readings give 109th (346-341 B.C.) and 105th (360-357 B.C.).

^e 346 B.C.—an emendation; the MSS. give A.U.C. 398 (356 B.C.).

brevissimum quo cernerentur spatium VII dierum adnotatum est, longissimum LXXX.¹

- 91 XXIII. Moventur autem aliae errantium modo, aliae immobiles haerent, omnes ferme sub ipso septentrione, aliqua eius parte non certa, sed maxime in candida quae lactei circuli nomen accepit. Aristoteles tradit et simul plures cerni, nemini conpertum alteri, quod equidem sciam, ventos autem ab his graves aestusve significari. fiunt et hibernis mensibus et in austrino polo, sed ibi citra ullum iubar. diraque conperta Aethiopum et Aegypti populis, cui nomen aevi eius rex dedit Typhon, ignea specie ac spirae modo intorta, visu quoque torvo, nec stella
- 92 verius quam quidam igneus nodus. sparguntur aliquando et errantibus stellis ceterisque crines. sed cometes nonnumquam² in occasura parte caeli est, terrificum magna ex parte sidus atque non leviter piatum, ut civili motu Octavio consule iterumque Pompei et Caesaris bello, in nostro vero aevo circa veneficium quo Claudius Caesar imperium reliquit Domitio Neroni, ac deinde principatu eius adsidium prope ac saevum. referre arbitrantur in quas partes sese iaculetur aut cuius stellae vires accipiat quasque similitudines reddat et quibus in

¹ Edd.: CLXXX.

² Rackham: nunquam.

^a Editors alter to 180, cf. Seneca *N.Q.* 7. 6. 1 etc.

^b *Meteorologica*, 345a 29.

^c The MSS. give 'never': Brotier quotes Aristotle *Meteorol.* 343b 14 ἀπαντες οἱ καθ' ἡμᾶς ὠμμένοι ἀνευ δύσεως ἠφανίσθησαν ἐν τῷ ὑπὲρ τοῦ ὀρίζοντος τόπῳ. But Pliny is not speaking of the disappearance of comets. If the MS. reading is accepted, *terrificum* begins a fresh sentence, and refers to comets in all quarters.

visibility on record for a comet is 7 days, the longest 80.^a

XXIII. Some comets move, like the planets, but others are fixed and stationary, almost all of them towards the due North, not in any particular part of it, though chiefly in the luminous region called the Milky Way. Aristotle also records^b that several may be seen at the same time—a fact not observed by anyone else, as far as I am aware—and that this signifies severe winds or heat. Comets also occur in the winter months and at the south pole, but comets in the south have no rays. A terrible comet was seen by the people of Ethiopia and Egypt, to which Typhon the king of that period gave his name; it had a fiery appearance and was twisted like a coil, and it was very grim to behold: it was not really a star so much as what might be called a ball of fire. Planets and all other stars also occasionally have spreading hair. But sometimes^c there is a comet in the western sky, usually a terrifying star and not easily expiated: for instance, during the civil disorder in the consulship^d of Octavius, and again during the war^e between Pompey and Caesar, or in our day about the time of the poisoning which secured the bequest of the empire by Claudius Caesar to Domitius Nero,^f and thereafter during Nero's principate shining almost continuously and with a terrible glare. People think that it matters in what direction a comet darts, what star's strength it borrows, what shapes it resembles, and in what

^d 43 B.C.

^e 49, 48 B.C.

^f Nero had succeeded his stepfather, 54 B.C., before he secured his position by murdering Britannicus.

93 locis emicet; tiliarum specie musicae arti portendere, obscenis autem moribus in verendis partibus signorum, ingeniis et eruditioni si triquetram figuram quadratamve paribus angulis ad aliquos perennium stellarum situs edat, venena fundere in capite septentrionalis austrinaeve serpentis.

Cometes in uno totius orbis loco colitur in templo Romae, admodum faustus divo Augusto iudicatus ab ipso, qui incipiente eo apparuit ludis quos faciebat Veneri Genetrici non multo post obitum patris
94 Caesaris in collegio ab eo instituto. namque his verbis id gaudium prodit: 'Iis ipsis ludorum meorum diebus sidus crinitum per septem dies in regione caeli quae sub septentrionibus est conspectum est.¹ id oriebatur circa undecimam horam diei clarumque et omnibus e terris conspicuum fuit. eo sidere significari vulgus credidit Caesaris animam inter deorum immortalium numina receptam, quo nomine id insigne simulacro capitis eius, quod mox in foro consecravimus, adiectum est.' haec ille in publicum: interiore gaudio sibi illum natum seque in eo nasci interpretatus est; et, si verum fatemur, salutare id terris fuit.

Sunt qui et haec sidera perpetua esse credant suoque ambitu ire, sed non nisi relicta ab sole cerni,

¹ est *add.* (vel *id om.*) *Rackham.*

^a Between the Great and Little Bear.

places it shines; that if it resembles a pair of flutes it is a portent for the art of music, in the private parts of the constellations it portends immorality, if it forms an equilateral triangle or a rectangular quadrilateral in relation to certain positions of the fixed stars, it portends men of genius and a revival of learning, in the head of the Northern^a or the Southern^b Serpent it brings poisonings.

The only place in the whole world where a comet is the object of worship is a temple at Rome. His late Majesty Augustus had deemed this comet very propitious to himself; as it had appeared at the beginning of his rule, at some games which, not long after the decease of his father Caesar, as a member of the college founded by him he was celebrating in honour of Mother Venus. In fact he made public the joy that it gave him in these words: 'On the very days of my Games a comet was visible for seven days in the northern part of the sky. It was rising about an hour before sunset, and was a bright star, visible from all lands. The common people believed that this star signified the soul of Caesar received among the spirits of the immortal gods, and on this account the emblem of a star was added to the bust of Caesar that we shortly afterwards dedicated in the forum.' This was his public utterance, but privately he rejoiced because he interpreted the comet as having been born for his own sake and as containing his own birth within it; and, to confess the truth, it did have a healthgiving influence over the world.

Some persons think that even comets are everlasting, and travel in a special circuit of their own, but are not visible except when the sun leaves them;

^b In the hand of Ophiuchus (*Anguinenens*).

Worship of comets.

alii vero qui nasci umore fortuito et ignea vi, ideoque¹ solvi.

95 XXIV. Idem Hipparchus numquam satis laudatus, ut quo nemo magis adprobaverit cognationem cum homine siderum animasque nostras partem esse caeli, novam stellam² in aevo suo genitam deprehendit, eiusque motu qua³ fulsit ad dubitationem est adductus anne hoc saepius fieret moverenturque et eae quas putamus adfixas, ideoque⁴ ausus rem etiam deo inprobam, adnumerare posteris stellas ac sidera ad nomen expungere organis excogitatis per quae singularum loca atque magnitudines signaret, ut facile discerni posset ex eo non modo an obirent ac nascerentur sed an omnino aliquae transirent moverenturque, item an crescerent minuerenturque, caelo in hereditate cunctis relicto, si quisquam qui cretionem eam caperet inventus esset.

96 XXV. Emicant et faces non nisi cum decidunt visae, qualis Germanico Caesare gladiatorium spectaculum edente praeter ora populi meridiano transcurrit. duo genera earum: alterum⁵ lampadas vocant, plane faces, alterum bolidas, quale Mutinensibus malis visum est. distant quod faces vestigia

¹ eoque? *Rackham.*

² *Dellefsen*: stellam et aliam, stellam vel aliam.

³ *v.l.* qua die.

⁴ *v.l.* idemque.

⁵ alterum *add.* *Rackham.*

^a Possibly the text should be altered to give 'and are dissolved into them.'

there are others, however, who hold that they spring into existence out of chance moisture and fiery force, and consequently^a are dissolved.

XXIV. Hipparchus before-mentioned, who can never be sufficiently praised, no one having done more to prove that man is related to the stars and that our souls are a part of heaven, detected a new star that came into existence during his lifetime; the movement of this star in its line of radiance led him to wonder whether this was a frequent occurrence, whether the stars that we think to be fixed are also in motion; and consequently he did a bold thing, that would be reprehensible even for God—he dared to schedule the stars for posterity, and tick off the heavenly bodies by name in a list, devising machinery by means of which to indicate their several positions and magnitudes, in order that from that time onward it might be possible easily to discern not only whether stars perish and are born, but whether some are in transit and in motion, and also whether they increase and decrease in magnitude—thus bequeathing the heavens as a legacy to all mankind, supposing anybody had been found to claim that inheritance!

XXV. There are also meteoric lights that are only seen when falling, for instance one that ran across the sky at midday in full view of the public when Germanicus Caesar was giving a gladiatorial show. Of these there are two kinds: one sort are called *lampades*, which means 'torches,' the other *bolidas* (missiles),—that is the sort that appeared at the time of the disasters of Modena.^b The difference

The astronomy of Hipparchus.

Meteors, varieties and instances of.

^b When Decimus Brutus was besieged there by Antony, 44 B.C.

longa faciunt priore ardente¹ parte, bolis vero perpetua ardens longiorem trahit limitem.

97 XXVI. Emicant et trabes simili modo, quas *δοκούς* vocant, qualis cum Lacedaemonii classe victi imperium Graeciae amisere. fit et caeli ipsius hiatus, quod vocant chasma, (XXVII) fit et sanguinea species et, quo nihil terribilius mortalium timori est, incendium ad terras cadens inde, sicut Olympiadis centesimae septimae anno tertio, cum rex Philippus Graeciam quateret. atque ego haec statis temporibus naturae vi² ut cetera arbitror existere, non, ut plerique, variis de causis quas ingeniorum acumen excogitat; quippe ingentium malorum fuere praenuntia, sed ea accidisse non quia haec facta sunt arbitror, verum haec ideo facta quia incasura erant illa, raritate autem occultam eorum esse rationem, ideoque non sicut exortus supra dictos defectusque et multa alia nosci.

98 XXVIII. Cernuntur et stellae cum sole totis diebus, plerumque et circa solis orbem ceu spiceae coronae et versicolores circuli, qualiter Augusto Caesare in prima iuventa urbem intrante post obitum patris ad nomen ingens capessendum. existunt eadem coronae circa lunam et circa nobilia astra caeloque inhaerentia. XXIX. Circa solem arcus

¹ ardentis? *Rackham*.

² vi add. *Mayhoff* (cf. 191).

^a At Cnidus, 394 B.C.

^b 349 B.C.

^c I.e. his great-uncle Julius Caesar, who not long before his death adopted Octavian into the Gens Julia as his heir: of this Augustus (then aged 18½) learnt on crossing from Apollonia and landing near Brindisi shortly after Caesar's murder.

between them is that 'torches' make long tracks, with their front part glowing, whereas a 'bolis' glows throughout its length, and traces a longer path.

XXVI. Other similar meteoric lights are 'beams.' in Greek *dokoi*, for example one that appeared when the Spartans were defeated^a at sea and lost the empire of Greece. There also occurs a yawning of the actual sky, called *chasma*, (XXVII) and also something that looks like blood, and a fire that falls from it to the earth—the most alarming possible cause of terror to mankind; as happened in the third year^b of the 107th Olympiad, when King Philip was throwing Greece into disturbance. My own view is that these occurrences take place at fixed dates owing to natural forces, like all other events, and not, as most people think, from the variety of causes invented by the cleverness of human intellects; it is true that they were the harbingers of enormous misfortunes, but I hold that those did not happen because the marvellous occurrences took place but that these took place because the misfortunes were going to occur, only the reason for their occurrence is concealed by their rarity, and consequently is not understood as are the risings and setting of the planets described above and many other phenomena.

XXVIII. Stars are also seen throughout the day-time in company with the sun, usually actually surrounding the sun's orb like wreaths made of ears of corn and rings of changing colour—for instance, when Augustus Caesar in early manhood entered the city after the death of his father^c to assume his mighty surname. Similar haloes occur round the moon and round the principal fixed stars. XXIX. A bow appeared round the sun in the consulship of Lucius

Solar and lunar halos.

PLINY: NATURAL HISTORY

adparuit L. Opimio Q. Fabio coss., orbis L. Porcio M'. Acilio, circulus rubri coloris L. Iulio P. Rutilio coss.

XXX. Fiunt prodigiosi et longiores solis defectus, qualis occiso dictatore Caesare et Antoniano bello
99 totius paene anni pallore continuo. XXXI. Et rursus soles plures simul cernuntur, nec supra ipsum nec infra sed ex obliquo, numquam iuxta nec contra terram, nec noctu sed aut oriente aut occidente. semel et meridie conspecti in Bosporo produntur, qui ab matutino tempore duraverunt in occasum. trinos soles antiqui saepius videre, sicut Sp. Postumio Q. Mucio et Q. Marcio M. Porcio et M. Antonio P. Dolabella et M. Lepido L. Planco coss., et nostra aetas vidit divo Claudio principe, consulatu eius Cornelio Orfito collega. plures quam tres simul visi ad hoc aevi numquam produntur.

XXXII. Lunae quoque trinae, ut Cn. Domitio C. Fannio consulibus, apparuere.

100 XXXIII. Quod plerique appellaverunt soles nocturnos, lumen de caelo noctu visum est C. Caecilio Cn. Papirio consulibus et saepe alias, ut diei species nocte luceret.

XXXIV. Clipeus ardens ab occasu ad ortum

^a 121 B.C.

^d 174 B.C.

^e 42 B.C.

^j 113 B.C.

^b 114 B.C.

^e 118 B.C.

^h A.D. 51.

^k 86 B.C.

^c 90 B.C.

^f 44 B.C.

^g 222 B.C.

Opimius and Quintus Fabius,^a a hoop in that of Gaius Porcius and Manius Acilius,^b and a red ring in that of Lucius Julius and Publius Rutilius.^c

XXX. Portentous and protracted eclipses of the sun occur, such as the one after the murder of Caesar the dictator and during the Antonine war which caused almost a whole year's continuous gloom. XXXI. Again, several suns are seen at once, neither above nor below the real sun but at an angle with it, never alongside of nor opposite to the earth, and not at night but either at sunrise or at sunset. It is also reported that once several suns were seen at midday at the Bosphorus, and that these lasted from dawn till sunset. In former times three suns have often been seen at once, for example in the consulships of Spurius Postumius and Quintus Mucius ^d of Quintus Marcius and Marcus Porcius,^e of Marcus Antonius and Publius Dolabella ^f and of Marcus Lepidus and Lucius Plancus; ^g and our generation saw this during the principate of his late Majesty Claudius, in his consulship, when Cornelius Orfitus was his colleague.^h It is not stated that more than three suns at a time have ever been seen hitherto.

Solar Eclipses.
Other astronomical portents.

XXXII. Also three moons have appeared at once, for instance in the consulship ⁱ of Gnaeus Domitius and Gaius Fannius.

XXXIII. A light from the sky by night, the phenomenon usually called 'night-suns,' was seen in the consulship ^j of Gaius Caecilius and Gnaeus Papirius and often on other occasions causing apparent daylight in the night.

XXXIV. In the consulship ^k of Lucius Valerius

scintillans transcucurrit solis occasu L. Valerio C. Mario consulibus.

XXXV. Scintillam visam¹ e stella cadere et augeri terrae adpropinquantem, at postquam lunae magnitudine² facta sit, inluxisse ceu nubilo die, dein, cum in caelum se reciperet, lampadem factam semel umquam proditur Cn. Octavio C. Scribonio consulibus. vidit id Silanus proconsul cum comitatu suo.

XXXVI. Fieri videntur et discursus stellarum, numquam temere ut non ex ea parte truces venti cooriantur.

101 XXXVII. Existunt stellae et in mari terrisque. vidi nocturnis militum vigiliis inhaerere pilis pro vallo fulgurum effigie eas, et antennis navigantium aliisque navium partibus cum³ vocali quodam sono insistunt ut volucres sedem ex sede mutant, graves, cum solitariae venere, mergentesque navigia, et si in carinae ima deciderint, exurentes, geminae autem salutes et prosperi cursus praenuntiae, quarum adventu fugari diram illam ac minacem appellatamque Helenam ferunt, et ob id Polluci ac Castori iis nomina⁴ adsignant, eosque in mari deos invocant. hominum quoque capita vespertinis horis magno praesagio circumfulgent, omnia incerta ratione et in naturae maiestate abdita.

102 XXXVIII. Hactenus de mundo ipso sideribusque. nunc reliqua caeli memorabilia. namque et hoc

¹ visam add. *Mayhoff*.

² *v.l.* in lunae magnitudinem.

³ *Mayhoff*: ceu.

⁴ *Deilefsen*: id nomen aut id numen.

and Gaius Marius a burning shield scattering sparks ran across the sky at sunset from west to east.

XXXV. In the consulship^a of Gnaeus Octavius and Gaius Scribonius a spark was seen to fall from a star and increase in size as it approached the earth, and after becoming as large as the moon it diffused a sort of cloudy daylight, and then returning to the sky changed into a torch; this is the only record of this occurring. It was seen by the proconsul Silanus and his suite.

XXXVI. Also stars appear to shoot to and fro; this invariably portends the rise of a fierce hurricane from the same quarter.

XXXVII. Stars also come into existence at sea and on land. I have seen a radiance of star-like appearance clinging to the javelins of soldiers on sentry duty at night in front of the rampart; and on a voyage stars alight on the yards and other parts of the ship, with a sound resembling a voice, hopping from perch to perch in the manner of birds. These when they come singly are disastrously heavy and wreck ships, and if they fall into the hold burn them up. If there are two of them, they denote safety and portend a successful voyage; and their approach is said to put to flight the terrible star called Helena: for this reason they are called Castor and Pollux, and people pray to them as gods for aid at sea. They also shine round men's heads at evening time; this is a great portent. All these things admit of no certain explanation; they are hidden away in the grandeur of nature.

XXXVIII. So much as to the world itself and the stars. Now the remaining noteworthy facts as to the heavens: for the name 'heaven' was also given

Atmospheric phenomena

PLINY: NATURAL HISTORY

caelum appellavere maiores quod alio nomine aera, omne quod inani simile vitalem hunc spiritum fundit. Infra lunam haec sedes, multoque inferior (ut animadverto propemodum constare), infinitum ex superiore natura aeris, infinitum et terreni halitus miscens utraque sorte confunditur. hinc nubila, tonitrua et alia fulmina, hinc grandines, pruinae, imbres, procellae, turbines, hinc plurima mortalium
 103 mala et rerum naturae pugna secum. terrena in caelum tendentia deprimit siderum vis, eademque quae sponte non subeant ad se trahit. decidunt imbres, nebulae subeunt, siccantur amnes, ruunt grandines, torrent radii et terram in medio mundi¹ undique impellunt, iidem infracti resiliunt et quae potavere² auferunt secum. vapor ex alto cadit rursumque in altum redit. venti ingruunt inanes, iidemque cum rapina remeant. tot animalium haustus spiritum e sublimi aere³ trahit, at ille contra nititur, tellusque ut inani caelo spiritum re-
 104 fundit.⁴ sic ultro citro conmeante natura ut tormento aliquo mundi celeritate discordia accenditur nec stare pugnae licet, sed adsidue rapta convolvitur et circa terram immenso rerum causas globo ostendit, subinde per nubes caelum aliud atque aliud⁵ obtexens. ventorum hoc regnum. itaque praecipua eorum

¹ *Dellefsen*: terram mediam aut medio aut mediam.

² *Dalec*: potuere.

³ aere *add.* *Rackham*.

⁴ *Rackham*: fundit aut infundit.

⁵ atque aliud *add. vet. apud Dalec (Brotier)*.

by our ancestors to this which is otherwise designated 'air'—the whole of that apparently empty space which pours forth this breath of life. This region below the moon, and a long way below it (as I notice is almost universally agreed), blends together an unlimited quantity from the upper element of air and an unlimited quantity of terrestrial vapour, being a combination of both orders. From it come clouds, thunder-claps and also thunder-bolts, hail, frost, rain, storms and whirlwinds; from it come most of mortals' misfortunes, and the warfare between the elements of nature. The force of the stars presses down terrestrial objects that strive to move towards the sky, and also draws to itself things that lack spontaneous levitation. Rain falls, clouds rise, rivers dry up, hailstorms sweep down; rays scorch, and impinging from every side on the earth in the middle of the world, then are broken and recoil and carry with them the moisture they have drunk up. Steam falls from on high and again returns on high. Empty winds sweep down, and then go back again with their plunder. So many living creatures draw their breath from the upper air; but the air strives in the opposite direction, and the earth pours back breath to the sky as if to a vacuum. Thus as nature swings to and fro like a kind of sling, discord is kindled by the velocity of the world's motion. Nor is the battle allowed to stand still, but is continually carried up and whirled round, displaying in an immense globe that encircles the world the causes of things, continually overspreading another and another heaven interwoven with the clouds. This is the realm of the winds. Consequently their nature is here pre-eminent, and almost includes all the rest of

natura ibi et ferme reliquas complexa aeris¹ causas, quoniam et tonitruum et fulminum iactus horum violentiae plerique adsignant, quin et ideo lapidibus pluere interim, quia vento sint rapti; et multa similiter. quam ob rem simul plura dicenda sunt.

105 XXXIX. Tempestatum imbriumque² quasdam stas esse causas, quasdam vero fortuitas aut adhuc rationis inconpertae, manifestum est. quis enim aestates et hiemes quaeque in temporibus annua vice intelleguntur siderum motu fieri dubitet? ut solis ergo natura temperando intellegitur anno, sic reliquorum quoque siderum propria est cuiusque³ vis et ad suam cuique naturam fertilis. alia sunt in liquorem soluti umoris fecunda, alia concreti in pruinas aut coacti in nives aut glaciati in grandines, alia flatus, alia teporis, alia vaporis, alia roris, alia frigoris.⁴ nec vero haec tanta debent existimari quanta cernuntur, cum esse eorum nullum minus
106 luna tam immensae altitudinis ratio declaret. igitur in suo quaeque motu naturam suam exercent, quod manifestum Saturni maxime transitus imbribus faciunt. nec meantium modo siderum haec vis est sed multorum etiam adhaerentium caelo, quotiens errantium accessu impulsa aut coniectu radiorum exstimulata sunt, qualiter in suculis sentimus accidere, quas Graeci ob id pluvio nomine hyadas⁵

¹ *Dellefsen*: complexa a se aut se (complexa eas, cf. 67 *fin.* *Mayhoff*).

² *Mayhoff*: rerumque.

⁴ *v.l.* rigoris.

³ *Mayhoff*: quibusque.

⁵ *hyadas om. vulg.* (cf. § 8).

the phenomena caused by the air, as most men attribute the hurling of thunderbolts and lightning to the winds' violence, and indeed hold that the cause of the rain of stones that sometimes occurs is that the stones are caught up by the wind; and likewise many other things. On this account more facts have to be set out at the same time.

XXXIX. Storms and rain obviously have some *Rain.* regular causes, but some that are accidental, or at all events not hitherto explained. For who can doubt that summer and winter and the yearly vicissitudes observed in the seasons are caused by the motion of the heavenly bodies? Therefore as the nature of the sun is understood to control the year's seasons, so each of the other stars also has a force of its own that creates effects corresponding to its particular nature. Some are productive of moisture dissolved into liquid, others of moisture hardened into frost or coagulated into snow or frozen into hail, others of a blast of air, others of warmth or heat, others of dew, others of cold. But it must not be thought that the stars are of the size that they appear to the sight, since the consideration of their immense altitude proves that none of them is smaller than the moon. Consequently each of them exercises its own nature in its own motion, a fact which the transits of Saturn in particular make clear by their storms of rain. Nor does this power belong to the moving stars only, but also to many of those that are fixed to the sky, whenever they are *Influence of heavenly bodies on weather,* impelled forward by the approach of the planets or goaded on by the impact of their rays, as we observe occurring in the case of the Little Pigs, the Greek name for which is consequently the Hyades, a word

appellant. quin et sua sponte quaedam statisque temporibus, ut haedorum exortus. Arcturi vero sidus non ferme sine procellosa grandine emergit.

- 107 XL. Nam caniculae exortu accendi solis vapores quis ignorat, cuius sideris effectus amplissimi in terra sentiuntur? fervent maria exoriente eo, fluctuant in cellis vina, moventur stagna. orygem appellat Aegyptus feram quam in exortu eius contra stare et contueri tradit ac velut adorare cum sternuerit. canes quidem toto eo spatio maxime in rabiem agi non est dubium.
- 108 XLI. Quin partibus quoque signorum quorundam sua vis inest, ut autumnali aequinoctio brumaeque, cum tempestatibus confici sidus intellegimus, nec imbris tantum tempestatibusque sed multis et corporum et ruris experimentis. adflantur alii sidere, alii commoventur statis temporibus alvo, nervis, capite, mente. olea et populus alba et salices solstitio folia circumagunt. floret ipso brumali die suspensa in tectis arentis herba pulei, rumpuntur
- 109 intentae spiritu membranae. miretur hoc qui non observet cotidiano experimento herbam unam, quae vocatur heliotropium, abeuntem solem intueri semper omnibusque horis cum eo verti vel nubilo obumbrante. iam quidem lunari potestate ostrearum conchyliorumque et concharum omnium corpora augeri ac rursus minui, quin et soricum fibras re-

^a Ὑδδης from ὕειν 'to rain,' not from ὕς 'a pig.'

denoting rain.^a Indeed some stars move of themselves and at fixed times—compare the rising of the Kids. But the rising of the constellation Arcturus is almost always accompanied by a hail-storm.

XL. For who is not aware that the heat of the sun increases at the rising of the Lesser Dog-star, whose effects are felt on earth very widely? At its rise the seas are rough, wine in the cellars ripples in waves, pools of water are stirred. There is a wild animal in Egypt called the gazelle that according to the natives stands facing this dog-star at its rise, and gazing at it as if in worship, after first giving a sneeze. It is indeed beyond doubt that dogs throughout the whole of that period are specially liable to rabies.

XLI. Moreover also the parts of some constellations have an influence of their own—for instance at the autumnal equinox and at mid-winter, when we learn by the storms that the sun is completing its orbit; and not only by falls of rain and storms, but by many things that happen to our bodies and to the fields. Some men are paralysed by a star, others suffer periodic disturbances of the stomach or sinews or head or mind. The olive and white poplar and willow turn round their leaves at the solstice. Fleabane hung up in the house to dry flowers exactly on midwinter day, and inflated skins burst. This may surprise one who does not notice in daily experience that one plant, called heliotrope, always looks towards the sun as it passes and at every hour of the day turns with it, even when it is obscured by a cloud. Indeed persistent research has discovered that the influence of the moon causes the shells of oysters, cockles and all shell-fish to grow larger and again smaller in bulk, and moreover that

and on animals and plants.

- spondere numero lunae exquisivere diligentiores, minimumque animal, formicam, sentire vires sideris
 110 interlunio semper cessantem. quo turpior homini inscitia est fatenti praecipue iumentorum quorundam in oculis morbos cum luna increcere ac minui. patrocinator vastitas caeli¹ immensa discreta altitudine² in duo atque septuaginta signa, hoc est rerum aut animantium effigies in quas digessere caelum periti. in his quidam mille sexcentas adnotare stellas, insignes scilicet effectu visu, exempli gratia in cauda tauri septem quas appellavere Vergilias, in fronte suculas, Booten quae sequitur Septem Triones.
- 111 XLII. Extra has causas non negaverim existere imbres ventosque, quoniam umidam a terra, alias vero propter vaporem fumidam exhalari caliginem certum est, nubesque e³ liquore⁴ egresso in sublime aut ex aere coacto in liquorem gigni. densitas earum corpusque haut dubio coniectatur argumento, cum solem obumbrent, perspicuum alias etiam urinantibus in quamlibet profundam aquarum altitudinem.
- 112 XLIII. Igitur non eam infitias posse in has et ignes superne stellarum decidere (quales sereno saepe cernimus, quorum ictu concuti aera verum est, quando et tela vibrata stridunt), cum vero in nubem perveniunt, vaporem dissonum gigni ut candente ferro in aquam demerso et fumidum vorticem volvi.

¹ *v.l. rei (et discretæ Rackham).*
² *latitudine Brotier.*
³ *e add. Rackham.*
⁴ *vapore edd. (sic Aristoteles).*

^a I.e. the number of days from the new moon.
^b The Hyades, see § 106.
^c The Oxherd.
^d The Wain, or Ursa Major and Ursa Minor.

the phases of the moon^a affect the tissues of the shrew-mouse, and that the smallest animal, the ant, is sensitive to the influence of the planet and at the time of the new moon is always slack. This makes ignorance all the more disgraceful to man, especially as he admits that with some cattle diseases of the eyes increase and diminish with the moon. His excuse is the heaven's vastness, being divided at an enormous height into 72 signs, that is, shapes of things or of animals into which the learned have mapped out the sky. In them they have indeed noted 1600 stars as being specially remarkable for their influence or their appearance, for instance the seven which they have named the Pleiades in the tail of the Bull and the Little Pigs^b in his forehead, and Bootes,^c the star that follows the Seven Plough-oxen.^d

XLII. I would not deny that rain and wind can arise from other causes than these; it is certain that the earth exhales a damp mist and at other times a smoky one due to vapour, and that clouds are formed out of moisture rising to a height or air condensed into moisture. Their density and bulk are conjectured with certain inference from the fact that they obscure the sun, which is otherwise visible even to those diving into water to whatever depth.

XLIII. Consequently I would not go against the view that it is also possible for the fires of stars to fall from above into the clouds (as we often see happen in fine weather, and the impact of these fires unquestionably shakes the air since even weapons when flung make a hissing noise); and that when they reach the cloud, a hissing steam is produced, just as when red-hot iron is plunged into water, and a coil of

Evaporation from the earth.

Storms caused by stars.

hinc nasci procellas, et si in nube luctetur flatus aut vapor, tonitrua edi, si erumpat ardens, fulmina, si longiore tractu nitatur, fulgetras. his findi nubem, illis perrumpi, et esse tonitrua inactorum ignium plagas ideoque protinus coruscare igneas nubium
 113 rimas. posse et repulsu siderum depressum qui a terra meaverit spiritum nube cohibitum tonare, natura strangulante sonitum dum rixetur, edito fragore cum erumpat ut in membrana spiritu intenta. posse et attritu, dum praeceps feratur, illum quisquis est spiritum accendi. posse et conflictu nubium elidi, ut duorum lapidum, scintillantibus fulgetris. sed haec omnia esse fortuita; hinc bruta fulmina et vana, ut quae nulla veniant ratione naturae, his percuti montes, his maria omnesque alios inritos iactus; illa vero fatidica ex alto, stisque de causis et ex suis venire sideribus.

114 XLIV. Simili modo ventos vel potius flatus posse et arido siccoque anhelitu terrae gigni non negaverim, posse et aquis aera exspirantibus qui neque in nebulam densetur nec crassescat in nubes, posse et solis impulsu agi, quoniam ventus haut aliud intellegatur

^a Those mentioned at the beginning of the chapter.

smoke whirls up. And I agree that these produce storms, and if there is wind or steam struggling in the cloud, it gives out claps of thunder; if it bursts out on fire, flashes of lightning, if it forces its way on a longer track, heat-lightning. The latter cleaves the cloud, the flashes burst through it, and thunder-claps are the blows of the fires colliding, causing fiery cracks at once to flash out in the clouds. It is also possible for breath emerging from the earth, when pressed down by the counter-impact of the stars, to be checked by a cloud and so cause thunder, nature choking down the sound while the struggle goes on but the crash sounding when the breath bursts out, as when a skin is stretched by being blown into. It is also possible for this breath, whatever it is, to be set on fire by the friction during its headlong progress. It is also possible for it to be struck out by the impact of the clouds, as by that of two stones, with heat-lightning flashing out like sparks. But all these occurrences are accidental—they cause mere senseless and ineffectual thunder-claps, as their coming obeys no principle of nature—they merely cleave mountains and seas, and all their other blows are ineffectual; but the former ^a are prophetic and sent from on high, they come by fixed causes and from their own stars.

XLIV. Similarly I am not prepared to deny that it is possible for winds or rather gusts of air to be produced also by a dry and parched breath from the earth, and also possible when bodies of water breathe out a vapour that is neither condensed into mist or solidified into clouds; and also they may be caused by the driving force of the sun, because wind is understood to be nothing else than a wave of air;

Air currents caused by contour of the earth.

quam fluctus aeris, pluribusque etiam modis. namque et e fluminibus ac sinibus et e mari videmus, et quidem tranquillo, et alios quos vocant altanos e terra consurgere; qui cum e mari redeunt, tropaei vocantur, si pergunt, apogei.

115 Montium vero flexus crebrique vertices et con-
flexa cubito aut confracta in umeros iuga ac ¹ concavi
vallium sinus, scindentes inaequalitate ideo resultan-
tem aera (quae causa etiam voces multis in locis
reciprocas facit sine fine) ventos generant. iam
quidam et specus, qualis in Dalmatiae ora vasto
praeceps hiatu, in quem deiecto levi pondere
quamvis tranquillo die turbini similis emicat procella;
nomen loco est Senta. quin et in Cyrenaica provin-
cia rupes quaedam austro traditur sacra, quam
profanum sit attrectari hominis manu confestim
austro volvente harenas. in domibus etiam multis
manu facta ² inclusa opacitate conceptacula auras
suas habent. adeo ³ causa non deest.

116 XLV. Sed plurimum interest flatus sit an ventus.
illos statos atque perspirantes, quos non tractus ali-
quis verum terrae sentiunt, qui non aerae, ⁴ non
procellae, ⁵ sed mares appellatione quoque ipsa venti
sunt, sive adsiduo mundi motu et contrario siderum
occursu nascuntur, sive hic est ille generabilis rerum
naturae spiritus huc illuc tamquam in utero aliquo

¹ ac add. Rackham.

³ ideo? Rackham.

⁵ Rackham: procella.

² v.l. madefacta.

⁴ Rackham: aera.

and in more ways as well. For we see winds arising both from rivers and bays and from the sea even when calm, and others, called *altani*, arising from the land; the latter when they come back again from the sea are called turning winds, but if they go on, off-shore winds.

The windings of mountains and their clustered peaks and ridges curved in an elbow or broken off into shoulders, and the hollow recesses of valleys, cleaving with their irregular contours the air that is consequently reflected from them (a phenomenon that in many places causes words spoken to be endlessly echoed) are productive of winds. So again are caverns, like the one with an enormous gaping mouth on the coast of Dalmatia, from which, if you throw some light object into it, even in calm weather a gust like a whirlwind bursts out; the name of the place is Senta. Also it is said that in the province of Cyrenaica there is a certain cliff, sacred to the South wind, which it is sacrilege for the hand of man to touch, the South wind immediately causing a sand-storm. Even manufactured vessels in many houses if shut up in the dark have peculiar exhalations. Thus there must be some cause for this.

XLV. But there is a great difference between a gust of air and a wind. The latter, regular and blowing steadily, and felt not by some particular tract only but by whole countries, and not being breezes nor tempests but *winds*—even their name being a masculine word—whether they are caused by the continuous motion of the world and the impact of the stars travelling in the opposite direction or whether wind is the famous ‘breath’ that generates the universe by fluctuating to and fro as in a

Causes of winds.

vagus, sive disparili errantium siderum ictu radiorum-
que multiformi iactu flagellatus aer, sive a suis
sideribus exeunt his propioribus sive ab illis caelo
adfixis cadunt, palam est illos quoque legem naturae
habere non ignotam etiamsi nondum percognitam.

117 Viginti amplius auctores Graeci veteres prodidere
de his observationes. quo magis miror orbe
discordi et in regna, hoc est in membra, diviso tot
viris curae fuisse tam ardua inventu, inter bella
praesertim et infida hospitia, piratis etiam omnium
mortalium hostibus transituros fama terrentibus,¹ ut
hodie quaedam in suo quisque tractu ex eorum
commentariis qui numquam eo accessere verius
noscat quam indigenarum scientia, nunc vero pace
tam festa, tam gaudente proventu literarum ² artium-
que principe, omnino nihil addisci nova inquisitione,
118 immo ne veterum quidem inventa perdisci. non
erant maiora praemia in multos dispersa fortunae
magnitudine, et ista plures sine praemio alio quam
posteris iuvandi eruerunt. mores hominum senuere,
non fructus, et immensa multitudo aperto quodcumque
est mari hospitalique litorum omnium adpulsu navigat,

¹ *Mayhoff*: transitus famae terrentibus aut terrentibus.

² *Mayhoff*: rerum.

sort of womb, or air whipped by the irregular impact
of the planets and the non-uniform emission of their
rays, or whether they issue forth from these nearer
stars which are their own or fall from those stars
which are fixed in the heaven—it is manifest that
the winds too obey a law of nature that is not un-
known, even if not yet fully known.

More than twenty Greek authors of the past
have published observations about these subjects. *Persistence
of meteor-
ological
study.* This makes me all the more surprised that, although
when the world was at variance, and split up into
kingdoms, that is, sundered limb from limb, so
many people devoted themselves to these abstruse
researches, especially when wars surrounded them
and hosts were untrustworthy, and also when rumours
of pirates, the foes of all mankind, terrified intending
travellers—so that now-a-days a person may learn
some facts about his own region from the note-
books of people who have never been there more
truly than from the knowledge of the natives—yet
now in these glad times of peace under an emperor
who so delights in productions of literature and science,
no addition whatever is being made to knowledge
by means of original research, and in fact even the
discoveries of our predecessors are not being
thoroughly studied. The rewards were not greater
when the ample successes were spread out over
many students, and in fact the majority of these
made the discoveries in question with no other
reward at all save the consciousness of benefiting
posterity. Age has overtaken the characters of
mankind, not their revenues, and now that every
sea has been opened up and every coast offers a
hospitable landing, an immense multitude goes

sed lucri, non scientiae, gratia; nec reputat caeca mens et tantum avaritiae intenta id ipsum scientia posse tutius fieri. quapropter scrupulosius quam instituto fortassis conveniat operi tractabo ventos, tot milia navigantium cernens.

119 XLVI. Veteres quattuor omnino servavere per totidem mundi partes (ideo nec Homerus plures nominat) hebeti, ut mox iudicatum est, ratione; secuta aetas octo addidit nimis subtili atque concisa. proximis inter utramque media placuit ad brevem ex numerosa additis quattuor. sunt ergo bini in quattuor caeli partibus: ab oriente aequinoctiali Subsolanus, ab oriente brumali Volturnus (illum Apelioten, hunc Graeci Eurum appellant); a meridie Auster et ab occasu brumali Africus (Notum et Liba nominant); ab occasu aequinoctiali Favonius, ab occasu solstitiali Corus (Zephyrum et Argesten vocant); a septentrionibus Septentrio, interque eum et exortum solstialem Aquilo (Aparctias et Boreas

120 dicti). numerosior ratio quattuor his interiecerat, Thrascian media regione inter Septentrionem et occasum solstialem, itemque Caecian media inter Aquilonem et exortum aequinoctialem ab ortu solstitiali, Phoenica media regione inter ortum

on voyages—but their object is profit not knowledge; and in their blind engrossment with avarice they do not reflect that knowledge is a more reliable means even of making profit. Consequently in view of these thousands of persons who go on voyages I will give a more detailed account of the winds than is perhaps suited to the task I have set in hand.

XLVI. The ancients noticed four winds in all, *Designation of winds.* corresponding to the four quarters of the world (this is the reason why even Homer mentions no more)—a dull-witted system, as it was soon afterwards considered; the following age added eight—this system on the other hand was too subtle and meticulous. Their successors adopted a compromise, adding to the short list four winds from the long one. There are consequently two winds in each of the four quarters of the heaven: Subsolanus blowing from the equinoctial sunrise (E). and Vulturinus from the winter sunrise (S.E.)—the former designated by the Greeks Apeliotes, the latter Eurus; Auster from the sun at midday (S.) and Africus from the winter sunset (S.W.)—named in Greek Notus and Libs; Favonius from the equinoctial sunset (W.), Corus from the sunset at the solstice (N.W.)—these the Greeks call Zephyr and Argestes; Septentrio from the North and Aquilo between him and sunrise at the solstice (N.E.)—called in Greek Aparctias and Boreas. The more numerous scheme had inserted four between these: Thrascias (N.N.W.) in the space between Septentrio (N.) and the sunset at the solstice (N.W.) and also Caecias (E.N.E.) in the space between Aquilo (N.E.) and the equinoctial sunrise (E.) on the side of the sunrise at the solstice, and Phoenix

brumalem et meridiem, item inter Liba et Notum compositum ex utroque medium inter meridiem et hibernum occidentem Libonotum. nec finis: alii quippe Mesen nomine etiamnum addidere inter Borean et Caecian, et inter Eurum Notumque Euronotum. sunt enim quidam peculiare quibusque gentibus venti, non ultra certum procedentes tractum, ut Atheniensibus Sciron, paulo ab Argeste deflexus, reliquae Graeciae ignotus: aliubi flatus
 121 idem Olympias vocatur: consuetudo omnibus his nominibus Argesten intellegi.¹ et Caecian aliqui vocant Hellespontian, et eosdem alii aliter. item in Narbonensi provincia clarissimus ventorum est Circius nec ullo violentia inferior, Ostiam plerumque secto² Ligustico mari perferens; idem non modo in reliquis partibus caeli ignotus est, sed ne Viennam quidem eiusdem provinciae urbem attingens paucis ante milibus iugi modici occurso tantus ille ventus coercetur. et Austros in Aegyptum penetrare negat Fabianus: quo fit manifesta lex naturae ventis etiam et tempore et fine dicto.

122 XLVII. Ver ergo aperit navigantibus maria, cuius in principio Favonii hibernum molliunt caelum sole Aquari XXV optinente partem: is dies sextus Februarias ante idus. competit ferme et hoc

¹ intellegit *Mayhoff*.

² *Mayhoff*: recto aut recta.

(S.S.E.) in the space between winter sunrise (S.E.) and midday (S.), and also between Libs (S.W.) and Notus (S.) the combination of the two, Libonotus (S.S.W.), midway between midday (S.) and winter sunset (S.W.). Nor is this the end, inasmuch as others have also added one named Meses between Boreas (N.E.) and Caecias (E.N.E.), and Euronotus between Eurus (S.E.) and Notus (S.). There are also certain winds peculiar to particular races, which do not go outside a special region, e.g. the Athenians have Sciron, slightly diverging from Argestes (N.W.), a name unknown to the rest of Greece—elsewhere the same breeze is called Olympias: customarily all these names are taken to denote Argestes. Some people call Caecias (E.N.E.) Hellespontias, and others have other variants for these names. Similarly in the province of Narbonne the most famous of the winds is Circius (W.N.W.), which is inferior to none other at all in force and which usually carries a vessel right across the Ligurian Sea to Ostia; the same wind is not only unknown in the remaining quarters of the sky, but it does not even touch Vienne, a city of the same province, a few miles before reaching which this mighty wind is checked by the obstacle of a moderate ridge of hills. Fabianus asserts that South winds also do not penetrate Egypt—which reveals the law of nature that even winds have their prescribed limits as well as seasons.

XLVII. Accordingly the spring opens the seas to voyagers; at its beginning the West winds soften the wintry heaven, when the sun occupies the 25th degree of Aquarius; the date of this is Feb. 8. This also practically applies to all the winds whose

Seasons of winds.

omnibus quos deinde ponam, per singulas intercalationes uno die anticipantibus rursusque lustro sequenti ordinem servantibus. Favonium quidam a. d. VIII kalendas Martias Chelidonian vocant ab hirundinis visu, nonnulli vero Ornithian ab adventu avium uno et LXX die post brumam flantem per dies novem. Favonio contrarius est quem Subsolanum
 123 appellavimus. dat aestatem exortus Vergiliarum in totidem partibus Tauri sex diebus ante Maias idus, quod tempus Austrinum est, huic vento Septentrione contrario. ardentissimo autem aestatis tempore exoritur Caniculae sidus sole primam partem Leonis ingrediente, qui dies XV ante Augustas kalendas est. huius exortum diebus octo ferme Aquilones antecedunt, quos Prodromos appellant.
 124 post biduum autem exortus iidem Aquilones constantius perflant diebus XXX,¹ quos Etesias appellant. mollire eos creditur solis vapor geminatus ardore sideris, nec ulli ventorum magis stati sunt. Post eos rursus Austri frequentes usque ad sidus Arcturi quod exoritur undecim diebus ante aequinoctium
 125 autumnii. cum hoc Corus incipit; Corus autumnat: huic est contrarius Volturnus. post id aequinoctium diebus fere quattuor et quadraginta Vergiliarum occasus hiemem inchoat, quod tempus in III idus Novembres incidere consuevit; hoc est Aquilonis hiberni multumque aestivo illi dissimilis, cuius ex adverso est Africus. et ante brumam autem septem

¹ *v. l.* diebus XL, his diebus.

positions I shall give afterwards, although every leap-year they come a day earlier, but they keep the regular rule in the period that follows. Certain persons give the name Chelidonian to the West wind on the 19th February, owing to the appearance of the swallow, but some call it Ornithian, from the arrival of the birds on the 71st day after the shortest day, when it blows for nine days. Opposite to the West wind is the wind that we have called Subsolanus (E.). The rise of the Pleiads in the same degrees of Taurus on May 10 brings summer; it is a period of South wind, Auster, the opposite of Septentrio. But in the hottest period of summer the Dog-star rises, when the sun is entering the first degree of Leo—this day is July 17. The Dog-star's rise is preceded for about eight days by North-east winds: these are called the Forerunners. But two days after his rising the North-east winds begin again, and continue blowing steadily for 30 days; these are called Etesian or Annual winds. They are believed to be softened by the sun's warmth being reinforced by the heat of the star; and they are the most regular of any of the winds. They are followed in turn by South winds, continuing to the rise of Arcturus, which occurs 40 days before the autumnal equinox. With the equinox begins the North-west wind; this, the opposite of Volturnus, marks the beginning of autumn. About 44 days after the autumnal equinox the setting of the Pleiads marks the beginning of winter, which it is customary to date on November 11; this is the period of the winter Aquilo, which is very unlike the summer one mentioned above; it is opposite to the South-west wind. But for six days before the shortest day and

diebus totidemque post eam sternitur mare alcyonum feturae, unde nomen hi dies traxere. reliquom tempus hiemat. nec tamen saevitia tempestatum cludit¹ mare: piratae primum coegere mortis periculo in mortem ruere et hiberna experiri maria, nunc idem hoc avaritia cogit.

- 126 XLVIII. Ventorum etiam frigidissimi sunt quos a septentrione diximus spirare et vicinus his Corus: hi et reliquos conpescunt et nubes abigunt. umidi Africus et praecipue Auster Italiae; narrant et in Ponto Caecian in se trahere nubes. sicci Corus et Volturnus praeterquam desinentes. nivales Aquilo et Septentrio; grandines Septentrio inportat et Corus. aestuosus Auster, tepidi Volturnus et Favonius; idem Subsolano sicciores, et in totum omnes a Septentrione et occidente sicciores quam a meridie
127 et oriente. saluberrimus autem omnium Aquilo, noxius Auster et magis siccus, fortassis quia umidus frigidior est; minus esurire eo spirante creduntur animantes. Etesiae noctu desinunt fere, et a tertia diei hora oriuntur; in Hispania et Asia ab oriente flatus est eorum, in Ponto ab Aquilone, reliquis in partibus a meridie. spirant autem et a bruma, cum vocantur Ornithiae, sed leniores et paucis diebus.
128 Permutant et duo naturam cum situ, Auster, Africae serenus, Aquilo nubilus. omnes venti vicibus suis spirant maiore ex parte ita ut² contrarius desinenti

¹ *v.l.* concludit.

² ita ut *Detlefsen*: aut ut *aut* autem (autem ut *Mayhoff*).

^a It was thought that there was less likelihood of encountering pirates in the winter.

six days after it the sea calms down for the breeding of the halcyons from which these days derive their name. The rest of the time there is wintry weather. However, not even the fury of the storms closes the sea; pirates first compelled men by the threat of death to rush into death and venture on the winter seas,^a but now avarice exercises the same compulsion.

XLVIII. The actually coldest winds are those that we have stated to blow from the North, and their neighbour Corus (N.W.); these check the other winds and also drive away the clouds. The South-west and especially the South are for Italy the damp winds; it is said that on the Black Sea the East-north-east also attracts clouds. The North-west and South-east are dry, except when they are falling. The North-east and North are snow winds; the North brings hailstorms, and so does the North-west. The South wind is hot, the South-east and West warm; the latter are also drier than the East wind, and in general all the northerly and westerly winds are drier than the southerly and easterly. The healthiest of all is the North wind; the South is harmful, and more so when dry, perhaps because when damp it is colder; living creatures are believed to be less hungry when it is blowing. Etesian winds usually cease at night and rise at eight o'clock in the morning; in Spain and Asia they are East winds, on the Black Sea North, and in other regions South. But they also begin to blow at midwinter (when they are called the Bird-winds), but more gently and only for a few days. Two winds also change their nature with their geographical position: the South wind in Africa is fine and the North-east cloudy. All the winds blow in their own turns, usually the one opposite to the one

Winds and weather.

incipiat. cum proximi cadentibus surgunt, a laevo latere in dextrum ut sol ambiunt. de ratione eorum menstrua quarta maxime luna decernit. iisdem autem ventis in contrarium navigatur prolatis pedibus, ut noctu plerumque adversa vela concurrant. Austro maiores fluctus eduntur quam Aquilone, quoniam ille infernus ex imo mari spirat, hic summo; ideoque post Austros noxii praecipue terrae motus.

129 noctu Auster, interdiu Aquilo vehementior, et ab ortu flantes diuturniores sunt ab occasu flantibus. Septentriones in pari fere¹ desinunt numero, quae observatio et in aliis multis rerum naturae partibus valet; mares itaque existimantur impares numeri sol et auget et comprimit flatus—auget exoriens occidensque, comprimit meridianus aestivis temporibus; itaque medio diei aut noctis plerumque sopiuntur, quia aut nimio frigore aut aestu solvuntur. et imbribus venti sopiuntur; exspectantur² autem maxime unde nubes discussae adaperuere caelum.

130 Omnium quidem (si libeat observare minimos ambitus) redire easdem vices quadriennio exacto Eudoxus putat, non ventorum modo verum et reliquarum tempestatum magna ex parte, et esse³ principium lustri eius semper intercalario anno Caniculae ortu.

De generalibus ventis haec.

¹ fere <dierum>? *Rackham*. ² exspectentur? *Rackham*.
³ *Rackham*: est.

^a I.e. East to West; the observer faces South.

^b I.e. the wind blowing on the fourth day of the new moon usually continues all the month.

that ceases beginning. When those next to the ones falling rise, they go round from left to right^a like the sun. The fourth moon usually decides about the course of the winds for the month.^b Vessels by means of slacking sheets can sail in contrary directions with the same winds, so that collisions occur, usually at night, between ships on opposite tacks. The South wind causes larger waves than the North-east because the former being below blows from the bottom of the sea but the latter from the top; consequently earthquakes following South winds are specially destructive. The South wind is more violent at night and the North-east wind in the daytime; and easterly winds continue longer than westerly. North winds usually stop after blowing an odd number of days, an observation that holds good in many other departments of nature also: this is why the odd numbers are thought to be masculine. The sun both increases and reduces the force of the wind—the former when rising and setting, the latter at midday in summer seasons; consequently the winds are usually lulled at midday or midnight, because either excessive cold or excessive heat makes them slack. Also winds are lulled by rain; but they are most to be expected from quarters where the clouds have broken, revealing a clear sky.

Eudoxus however thinks that (if we choose to study the minimal circuits) there is a regular recurrence of all phenomena—not only of winds but largely of other sorts of bad weather as well—in four-yearly periods, and that the period always begins in a leap-year at the rising of Sirius.

These are our observations with regard to the winds that are regular.

- 131 XLIX. Nunc de repentinis flatibus, qui exhalante terra, ut dictum est, coorti rursusque deiecti in terram¹ obducta nubium cute, multiformes existunt. vagi quippe et ruentes torrentium modo (ut aliquis placere ostendimus) tonitrua et fulgura edunt. maiore vero inlati pondere incursuque si late siccam rupere nubem, procellam gignunt quae vocatur a Graecis ecnephas, sin vero depresso sinu artius rotati effregerunt, sine igne, hoc est sine fulmine, verticem faciunt qui typhon vocatur, id est vibratus
- 132 ecnephas. defert hic secum aliquid abreptum e nube calidi² convolvens versansque et ruinam suam illo pondere adgravans ac locum ex loco mutans rapida vertigine, praecipua navigantium pestis, non antemnas modo verum ipsa navigia contorta frangens, tenui remedio aceti in advenientem effusi, cui frigidissima est natura. idem in isu ipso repercussus correpta secum in caelum refert sorbetque in excelsum.
- 133 L. Quod si maiore depressae nubis eruperit specu sed minus lato quam procella, nec sine fragore, turbinem vocant proxima quaeque prosternentem. idem ardentior accensusque dum furit, prester vocatur amburens contacta pariter et proterens. Non

¹ *Caesarius*: interim.

² *Dellefsen*: gelidi aut gelida.

^a § 111

^b § 112.

^c Cf. § 133.

XLIX. Now as to sudden blasts, which arise as has been said^a from exhalations of the earth, and fall back again to the earth drawing over it an envelope of cloud; these occur in a variety of forms. The fact is that their onrush is quite irregular, like that of mountain torrents (as we have pointed out^b is the view of certain persons), and they give forth thunder and lightning. If travelling with a heavier momentum they burst a great gap in a dry cloud, they produce a storm called by the Greeks a cloudburst; but if they break out from a downward curve of cloud^c with a more limited rotation, they cause a whirl unaccompanied by fire—I mean by lightning—that is called a typhoon, which denotes a whirling cloudburst. This brings down with it a portion of heat torn from a cloud, which it turns and whirls round, increasing its own downward velocity by its weight, and shifting from place to place with a rapid whirl; it is specially disastrous to navigators, as it twists round and shatters not only the yards, but the vessels themselves, leaving only the slender remedy of pouring out vinegar in advance of its approach, vinegar being a very cold substance. The same whirlwind when beaten back by its very impact snatches things up and carries them back with it to the sky, sucking them high aloft.

L. But if it bursts out of a larger cavern of downward pressing cloud but not so wide a one as in the case of a storm, and is accompanied by a crashing noise, this is what they call a whirlwind, which overthrows everything in its neighbourhood. When the same rages hotter and with a fiery flow, it is called a *prester*, as while sweeping away the things it comes in contact with it also scorches them up. But a

- fit autem aquilonius typhon, nec nivalis aut nive
 iacente¹ ecnephas. quod si simul rupit nubem
 exarsitque et ignem habuit, non postea concepit,
 134 fulmen est. distat a prestere quo flamma ab igni:
 hic late funditur flatu, illud conglobatur impetu.
 vertex autem remeando distat a turbine et quo
 stridor a fragore; procella latitudine ab utroque,
 disiecta nube verius quam rupta. fit et caligo
 beluae similis in² nube dira navigantibus. vocatur et
 columna, cum spissatus umor rigensque ipse se sus-
 tintet; ex eodem genere et aulon, cum veluti fistula
 nubes aquam trahit.
- 135 LI. Hieme et aestate rara fulmina contrariis de
 causis, quoniam hieme densatus aer nubium crassiore
 corio spissatur, omnisque terrarum exhalatio rigens
 ac gelida quicquid accipit ignei vaporis exstinguit.
 quae ratio immunem Scythiam et circa rigentia
 a fulminum casu praestat, e diverso nimius ardor
 Aegyptum, siquidem calidi siccae halitus terrae raro
 admodum tenuisque et infirmas densantur in nubes.
- 136 vere autem et autumnno crebriora fulmina, correptis³
 in utroque tempore aestatis hiemisque causis; quia
 ratione crebra in Italia, quia mobilior aer mitiore
 hieme et aestate nimbose semper quodammodo ver-
 nat vel autumnat. sunt in⁴ Italiae quoque partibus iis

¹ *v.l.* aut nivem iaciens (*del. ut gloss. Pintianus*).

² in *Mayhoff*: e aut *om. codd.* ³ *Rackham*: corruptis.

⁴ in *add. Rackham*.

typhoon does not occur with a northerly wind, nor a
 cloudburst with snow or when snow is lying. If it
 flared up as soon as it burst the cloud, and had fire in
 it, did not catch fire afterwards, it is a thunder-
 bolt. It differs from a fiery pillar in the way in which
 a flame differs from a fire: a fiery pillar spreads out
 its blast widely, whereas a thunderbolt masses
 together its onrush. On the other hand a tornado
 differs from a whirlwind by returning, and as a whizz
 differs from a crash; a storm is different from either
 in its extent—it is caused by the scattering rather
 than the bursting of a cloud. There also occurs a
 darkness caused by a cloud shaped like a wild
 monster—this is direful to sailors. There is also what
 is called a column, when densified and stiffened
 moisture raises itself aloft; in the same class also is
 a waterspout, when a cloud draws up water like a pipe.

LI. Thunderbolts are rare in winter and in
 summer, from opposite causes. In winter, owing to
 the thicker envelope of cloud, the air is rendered
 extremely dense, and all the earth's exhalation being
 stiff and cold extinguishes whatever fiery vapour it
 receives. This reason renders Scythia and the
 frozen regions round it immune from the fall of
 thunderbolts, while conversely the excessive heat
 does the same for Egypt, inasmuch as the hot and
 dry exhalations from the earth condense very rarely,
 and only form thin and feeble clouds. But in spring
 and autumn thunderbolts are more frequent, their
 summer and winter causes being combined in each
 of those seasons; this explains why they are fre-
 quent in Italy, where the milder winter and stormy
 summer make the air more mobile, and it is always
 somewhat vernal or autumnal. Also in the parts of

*Thunder-
 bolts, their
 seasons;*

quae a septentrione descendunt ad teporem, qualis est urbis et Campaniae tractus, iuxta hieme et aestate fulgurat, quod non in ¹ alio situ evenit.²

137 LII. Fulminum ipsorum plura genera traduntur. quae sicca veniunt non adurunt sed dissipant, quae fumida ³ non urunt sed infuscant. tertium est quod clarum vocant, mirificae maxime naturae, quo dolia exhauriuntur intactis operimentis nulloque alio vestigio relicto, aurum et aes et argentum liquatur intus, sacculis ipsis nullo modo ambustis ac ne confuso quidem signo cerae. Marcia femina ⁴ princeps Romanarum icta gravida partu exanimato ipsa citra ullum aliud incommodum vixit. in Catilinariis prodigiis Pompeiano ex municipio M. Herennius decurio sereno die fulmine ictus est.

138 LIII. Tuscorum litterae novem deos emittere fulmina existimant, eaque esse undecim generum, Iovem enim trina iaculari. Romani duo tantum ex iis servavere, diurna attribuentes Iovi, nocturna Summano, rariora sane eadem de causa frigidioris caeli. Etruria erumpere terra quoque arbitratur, quae infera appellat, brumali tempore facta saeva maxime et exsecrabilia, cum sint omnia quae terrena existimant non illa generalia nec a sideribus venientia

¹ in<ullo>alio? Rackham.

² evenit om. codd. plurimi.

³ fumida (φολόεντα Aristotle Meteorol. 371 a 21) Brotier: umida.

⁴ femina add. Mayhoff.

Italy that slope down from the north towards the warmth, such as the district of Rome and the Campagna, lightning occurs in winter just as in summer, which does not happen in any other locality.

LII. Of thunderbolts themselves several varieties ^{their varieties.} are reported. Those that come with a dry flash do not cause a fire but an explosion. The smoky ones do not burn but blacken. There is a third sort, called 'bright thunderbolts,' of an extremely remarkable nature; this kind drains casks dry without damaging their lids and without leaving any other trace, and melts gold and copper and silver in their bags without singeing the bags themselves at all, and even without melting the wax seal. Marcia, a lady of high station at Rome, was struck by lightning when *enceinte*, and though the child was killed, she herself survived without being otherwise injured. Among the portents in connexion with Catiline, a town-councillor of Pompei named Marcus Herennius was struck by lightning on a fine day.

LIII. The Tuscan writers hold the view that ^{Views as to their causes.} there are nine gods who send thunderbolts, and that these are of eleven kinds, because Jupiter hurls three varieties. Only two of these deities have been retained by the Romans, who attribute thunderbolts in the daytime to Jupiter and those in the night to Summanus, the latter being naturally rare because the sky at night is colder. Tuscany believes that some also burst out of the ground, which it calls 'low bolts,' and that these are rendered exceptionally direful and accursed by the season of winter, though all the bolts that they believe of earthly origin are not the ordinary ones and do not come

sed ex proxima atque turbidior natura: argumentum evidens, quod omnia e superiore caelo decidentia obliquos habent ictus, haec autem quae vocant
 139 terrena rectos. et quae¹ ex propiore materia cadunt ideo creduntur e terra exire quoniam ex repulso nulla vestigia edunt, cum sit illa ratio non inferi ictus sed aversi.² a Saturni ea sidere proficisci subtilius ista consecrati putant, sicut cremantia a Martis, qualiter cum Volsinii, oppidum Tuscorum opulentissimum, totum concrematum est fulmine. vocant et familiaria, in totam vitam fatidica, quae prima fiunt familiam suam cuique indepto. ceterum existimant non ultra decem annos portendere privata praeterquam aut primo matrimonio facta aut natali die, publica non ultra tricesimum annum praeterquam in deductione oppidi.

140 LIV. Exstat annalium memoria sacris quibusdam et precationibus vel cogi fulmina vel inpetrari. vetus fama Etruriae est inpetratum, Volsinios urbem depopulatis agris subeunte monstro quod vocavere Oltam, evocatum a Porsina suo rege. et ante eum a Numa saepius hoc factitatum in primo annalium suorum tradit L. Piso, gravis auctor, quod imitatum parum rite Tullum Hostilium ictum fulmine. lucos-

¹ Et quae *Mayhoff*: sed quia.

² *Rackham*: aversi.

^a I.e. the air.

from the stars but from the nearer and more disordered element^a: a clear proof of this being that all those coming from the upper heaven deliver slanting blows, whereas these which they call earthly strike straight. And those that fall from the nearer elements are supposed to come out of the earth because they leave no traces as a result of their rebound, although that is the principle not of a downward blow but of a slanting one. Those who pursue these enquiries with more subtlety think that these bolts come from the planet Saturn, just as the inflammatory ones come from Mars, as, for instance, when Bolsena, the richest town in Tuscany, was entirely burnt up by a thunderbolt. Also the first ones that occur after a man sets up house for himself are called 'family meteors,' as foretelling his fortune for the whole of his life. However, people think that private meteors, except those that occur either at a man's first marriage or on his birthday, do not prophecy beyond ten years, nor public ones beyond the 30th year, except those occurring at the colonization of a town.

LIV. Historical record also exists of thunderbolts being either caused by or vouchsafed in answer to certain rites and prayers. There is an old story of the latter in Tuscany, when the portent which they called Oltam came to the city of Bolsena, when its territory had been devastated; it was sent in answer to the prayer of its king Porsina. Also before his time, as is recorded on the reliable authority of Lucius Piso in his *Annals* I, this was frequently practised by Numa, though when Tullus Hostilius copied him with incorrect ritual he was struck by lightning. We also have groves and

Thunderbolts in answer to prayer.

que et aras et sacra habemus, interque Statores ac Tonantes et Feretrios Elicium quoque accepimus
 141 Iovem. varia in hoc vitae sententia et pro cuiusque animo. imperare naturae sacra audacis est credere, nec minus hebetis beneficiis abrogare vires, quando in fulgurum quoque interpretatione eo profecit scientia ut ventura alia finito die praecinatur et an peremptura sint factum¹ aut² prius alia facta³ quae lateant, innumerabilibus in utroque publicis privatisque experimentis. quamobrem sint ista ut rerum naturae libuit, alias certa alias dubia, aliis probata aliis damnanda, nos cetera⁴ quae sunt in his memorabilia non omittemus.

142 LV. Fulgetrum prius cerni quam tonitrum audiri, cum simul fiant, certum est (nec mirum, quoniam lux sonitu velocior); ictum autem et sonitum congruere ita modulante natura, sed sonitum profecti esse fulminis, non inlati; etiamnum spiritum ociosem fulmine, ideo quati prius omne et adflari quam percuti; nec quemquam tangi qui viderit fulmen aut tonitrum audierit. laeva prospera existimantur quo-

¹ v.l. fatum.

² v.l. aut apertura.

³ v.l. fata.

⁴ v.l. de cetero.

* Jupiter to whom *spolia opima* were offered in return for victory in battle.

altars and rites, and among the other Jupiters, the Stayers and Thunderers and Receivers of Offerings,* tradition gives us Jupiter the Invoked. On this matter the opinion of mankind varies, in correspondence with our individual dispositions. It takes a bold man to believe that Nature obeys the behests of ritual, and equally it takes a dull man to deny that ritual has beneficent powers, when knowledge has made such progress even in the interpretation of thunderbolts that it can prophecy that others will come on a fixed day, and whether they will destroy a previous one or other previous ones that are concealed: this progress has been made by public and private experiments in both fields. In consequence although such indications are certain in some cases but doubtful in others, and approved to some persons but in the view of others to be condemned, in accordance with Nature's will and pleasure, we for our part are not going to leave out the rest of the things worth recording in this department.

LV. It is certain that when thunder and lightning occur simultaneously, the flash is seen before the thunderclap is heard (this not being surprising, as light travels more swiftly than sound); but that Nature so regulates the stroke of a thunderbolt and the sound of the thunder that they occur together, although the sound is caused by the bolt starting, not striking; moreover that the current of air travels faster than the bolt, and that consequently the object always is shaken and feels the blast before it is struck; and that nobody has ever seen the lightning or heard the thunder in advance. Flashes on the left are considered lucky, because the sun

Thunder and lightning.

niam laeva parte mundi ortus est; nec tam adventus spectatur quam reditus, sive ab ictu resilit ignis sive opere confecto aut igne consumpto spiritus remeat.

- 143 In sedecim partes caelum in eo spectu divisere Tusci: prima est a septemtrionibus ad aequinoctialem exortum, secunda ad meridiem, tertia ad aequinoctialem occasum, quarta obtinet quod reliquum est ab occasu ad septemtriones; has iterum in quaternas divisere partes, ex quibus octo ab exortu sinistras, totidem e contrario appellavere dextras. ex his maxime dirae quae septemtriones ab occasu attingunt. itaque plurimum refert unde venerint fulmina et quo concesserint. optimum est in
- 144 exortivas redire partes. ideo cum a prima caeli parte venerint et in eandem concesserint, summa felicitas portendetur, quale Sullae dictatori ostentum datum accepimus; cetera ad ipsius mundi portionem¹ minus prospera aut dira. quidam² fulgura enuntiare non putant fas nec audire, praeterquam si hospiti indicerentur aut parenti.

Magna huius observationis vanitas tacta Iunonis aede Romae deprehensa est Scauro consule qui mox princeps fuit.

- 145 Noctu magis quam interdiu sine tonitribus fulgurat. unum animal hominem non semper ex-

¹ *Mayhoff* (cf. xiii 133 etc.): cetera ipsius mundi portione.

² *Rackham*: quaedam.

^a It is assumed that an observer faces South.

^b 115 B.C.

^c Cf. XXXVI. 144 *princeps civitatis*.

rises on the left-hand^a side of the firmament; and their approach is not so visible as their return, whether after the blow a fire springs from it or the breath returns when its work is done or its fire used up.

In making these observations the Tuscans divided the heaven into sixteen parts: the first quarter is from the North to the equinoctial sunrise (East), the second to the South, the third to the equinoctial sunset (West), and the fourth occupies the remaining space extending from West to North; these quarters they subdivided into four parts each, of which they called the eight starting from the East the left-hand regions and the eight opposite ones the right-hand. Of these the most formidable are those lying between West and North. Hence the line of approach and the line of retirement of thunderbolts is of very great importance. It is best for them to return to parts in the region of sunrise. Accordingly it will be a portent of supreme happiness when they come from the first part of the sky and retire to the same part—a sign that history records to have been vouchsafed to the dictator Sulla; but all the others are less fortunate or actually direful, in accordance with the division of the actual firmament where they occur. Some people think it wrong to give or to listen to reports of thunderbolts, except if they are told to a guest or a parent.

The great folly of paying attention to these occurrences was discovered when the Temple of Juno at Rome was struck by lightning in the consulship^b of Scaurus, who was afterwards head of the state.^c

Lightning unaccompanied by thunder occurs more often by night than in the daytime. Man is the one

*Augury by
thunderbolts.*

*Lightning,
effects of.*

stinguit, cetera illico, hunc videlicet natura tribuente honorem cum tot beluae viribus praestent. omnia contrarias incubant in partes. homo nisi convertatur vi percussus non exspirat. superne icti considunt. vigilans ictus coniventibus oculis, dormiens patentibus reperitur. hominem ita exanimatum cremari fas non est, condi terra religio tradidit. nullum animal nisi exanimatum fulmine accenditur. volnera fulminatorum frigidiora sunt
 146 reliquo corpore. LVI. ex iis quae terra gignuntur lauri fruticem non icit. nec umquam quinque altius pedibus descendit in terram; ideo pavidi altiores specus tutissimos putant, aut tabernacula pellibus beluarum quas vitulos appellant, quoniam hoc solum animal ex marinis non percutiat, sicut nec e volucris aquilam, quae ob hoc armigera huius teli fingitur. in Italia inter Tarracinam et aedem Feroniae turres belli Caesariani¹ temporibus desiere fieri nulla non earum fulmine diruta.

147 LVII. Praeter haec in² inferiore caelo relatum in monumenta est lacte et sanguine pluisse M'. Acilio C. Porcio coss. et saepe alias carne sicut P. Volumnio Servio Sulpicio coss., exque ea non putruisse quod non

¹ *Detlefsen*: bellicoes (belli civilis *Mayhoff*).

² in *om. v.l.*

^a 114 B.C.

^b 461 B.C.

creature that is not always killed when struck—all others are killed on the spot; nature doubtless bestows this honour on man because so many animals surpass him in strength. All things (when struck) fall in the opposite direction to the flash. A man does not die unless the force of the blow turns him right round. Men struck from above collapse. A man struck while awake is found with his eyes shut; while asleep, with them open. It is not lawful to cremate a man who loses his life in this manner; religious tradition prescribes burial. No living creature can be burnt by lightning without being killed. The temperature of the wound of those struck is lower than that of the rest of the body. LVI. Among things that grow in the ground, it does not strike a laurel bush. It never penetrates more than five feet into the earth; consequently when in fear of lightning men think caves of greater depth are the safest, or else a tent made of the skin of the creatures called sea-calves, because that alone among marine animals lightning does not strike, just as it does not strike the eagle among birds; this is why the eagle is represented as armed with a thunderbolt as a weapon. In Italy in the time of the Caesarian war people ceased to build towers between Terracina and the Temple of Feronia, as every tower there was destroyed by lightning.

LVII. Besides these events in the lower sky, it is entered in the records that in the consulship^a of *Rain of blood, etc.* Manius Acilius and Gaius Porcius it rained milk and blood, and that frequently on other occasions there it has rained flesh, for instance in the consulship^b of Publius Volumnius and Servius Sulpicius, and that none of the flesh left unplundered by birds of prey

diripuissent aves, item ferro in Lucanis anno antequam M. Crassus a Parthis interemptus est omnesque cum eo Lucani milites, quorum magnus numerus in exercitu erat: effigies quo¹ pluit ferri spongearum² similis fuit; haruspices praemonuerunt superna volnera. L. autem Paulo C. Marcello coss. lana pluit circa castellum Compsanum, iuxta quod post annum T. Annius Milo occisus est. eodem causam dicente lateribus coctis pluuisse in acta eius anni relatum est.

148 LVIII. Armorum crepitus et tubae sonitus auditos e caelo Cimbricis bellis accepimus, crebroque et prius et postea. tertio vero consulatu Mari ab Amerinis et Tudertibus spectata arma caelestia ab ortu occasuque inter se concurrentia, pulsus quae ab occasu erant. ipsum ardere caelum minime mirum est et saepius visum maiore igne nubibus conreptis.

149 LIX. Celebrant Graeci Anaxagoran Clazomenium Olympiadis septuagesimae octavae secundo anno praedixisse caelestium litterarum³ scientia quibus diebus saxum casurum esset e sole, idque factum interdiu in Thraciae parte ad Aegos flumen (qui lapis etiamnunc ostenditur magnitudine vehis, colore adusto) comete quoque illis noctibus flagrante. quod si quis praedictum credat, simul fateatur necesse est

¹ *Mayhoff*: que aut quae.

² *Mayhoff*: spongearum ferri aut spongearum.

³ *v.l.* caelestium militiarum.

^a In the battle of Carrhae 53 B.C.

^b I.e. lumps of porous stone.

^c 49 B.C. ^d Now Conza, in Samnium.

^e From North Germany, 113-101 B.C.

103 B.C. ^f Now Todi. ^g 467 B.C.

went bad; and similarly that it rained iron in the district of Lucania the year before Marcus Crassus was killed^a by the Parthians and with him all the Lucanian soldiers, of whom there was a large contingent in his army; the shape of the iron that fell resembled sponges^b; the augurs prophesied wounds from above. But in the consulship^c of Lucius Paullus and Gaius Marcellus it rained wool in the vicinity of Compsa^d Castle, near which Titus Annius Milo was killed a year later. It is recorded in the annals of that year that while Milo was pleading a case in court it rained baked bricks.

LVIII. We are told that during the wars with the Cimbri^e a noise of clanging armour and the sounding of a trumpet were heard from the sky, and that the same thing has happened frequently both before then and later. In the third consulship^f of Marius the inhabitants of Ameria and Tuder^g saw the spectacle of heavenly armies advancing from the East and the West to meet in battle, those from the West being routed. It has often been seen, and is not at all surprising, that the sky itself catches fire when the clouds have been set on fire by an exceptionally large flame.

LIX. The Greeks tell the story that Anaxagoras of Clazomenae in the 2nd year^h of the 78th Olympiad was enabled by his knowledge of astronomical literature to prophecy that in a certain number of days a rock would fall from the sun; and that this occurred in the daytime in the Goat's River district of Thrace (the stone is still shown—it is of the size of a wagon-load and brown in colour), a comet also blazing in the nights at the time. If anyone believes in the fact of this prophecy, that involves his allowing

maioris miraculi divinitatem Anaxagorae fuisse, solvi-
que rerum naturae intellectum et confundi omnia si
aut ipse sol lapis esse aut umquam lapidem in eo
fuisse credatur. decidere tamen crebro non erit
150 dubium. in Abydi gymnasio ex ea causa colitur
hodieque modicus quidem sed quem in medio
terrarum casurum idem Anaxagoras praedixisse
narratur. colitur et Cassandriae, quae Potidaea
vocitata est, ob id deductae. ego ipse vidi in
Vocontiorum agro paulo ante delapsum.¹

LX. Arcus vocamus extra miraculum frequentes
et extra ostentum; nam ne pluvios quidem aut
serenos dies cum fide portendunt. manifestum est
radium solis inmissum cavae nubi repulsa acie in
solem refringi, colorumque varietatem mixtura
nubium, ignium, aeris fieri. certe nisi sole adverso
non fiunt, nec umquam nisi dimidia circuli forma, nec
noctu, quamvis Aristoteles prodat aliquando visum,
quod tamen fatetur idem non nisi quartadecima²
151 luna fieri posse. fiunt autem hieme maxime ab
aequinotio autumnali die decrescente; quo rursus
crescente ab aequinotio verno non exsistunt, nec
circa solstitium longissimis diebus, bruma vero [id
est brevissimis³] frequenter; iidem sublimes humili

¹ *Rackham*: delatum.

² *edd.* (= XIV): tricesima (= XXX).

³ *Seclusit Mayhoff.*

^a 'Potidaea' from *ποτί* = *πρός* and *δαίωμα* 'to burn' (Brotier)

^b The MSS. give 'brought in' (from the country).

^c Aristotle, *Meteorologica*, III, ii, 372a, 27 *ἐν τῇ πανσελήνῳ*
(meaning any time when the moon is more than at half).

^d The omitted clause 'that is, at the shortest days' looks
like a philological note on 'bruma.'

that the divining powers of Anaxagoras covered a
greater marvel, and that our understanding of the
physical universe is annihilated and everything thrown
into confusion if it is believed either that the sun is
itself a stone or ever had a stone inside it. But it
will not be doubted that stones do frequently fall. A
stone is worshipped for this reason even at the present
day in the exercising ground at Abydos—one of
moderate size, it is true, but which the same Anax-
agoras is said to have prophesied as going to fall in the
middle of the country. There is also one that is wor-
shipped at Cassandria, the place that has been given
the name of Potidaea,^a and where a colony was
settled on account of this occurrence. I myself
saw one that had recently come down ^b in the territory
of the Vocontii.

LX. The common occurrences that we call rainbows *Rainbows.*
have nothing miraculous or portentous about them,
for they do not reliably portend even rain or fine
weather. The obvious explanation of them is that
a ray of the sun striking a hollow cloud has its point
repelled and is reflected back to the sun, and that the
diversified colouring is due to the mixture of clouds,
fires and air. Rainbows certainly do not occur except
opposite to the sun, and never except in semi-circular
shape, and not at night time, although Aristotle
does state that a rainbow has been sometimes seen at
night, though he also admits that it cannot happen
except on the 14th day of the lunar month.^c Rain-
bows in winter occur chiefly when the day is drawing
in after the autumnal equinox; when the day draws
out again after the vernal equinox they do not occur,
nor in the longest days about the solstice, but they
occur frequently in midwinter ^d; also they are high

sole humilesque sublimi, et minores oriente aut occidente sed in latitudinem demissi, meridie exiles verum ambitus maioris. aestate autem per meridiem non cernuntur post autumnus aequinoctium quacumque hora; nec umquam plures simul quam duo.

- 152 LXI. Cetera eiusdem naturae non multis dubia esse video: grandinem congelato imbri gigni et nivem eodem umore mollius coacto, pruina autem ex rore gelido; per hiemem nives cadere, non grandines, ipsasque grandines interdum saepius quam noctu, et multo celerius resolvi quam nives; nebulas nec aestate nec maximo frigore exsistere, rores neque gelu neque ardoribus neque ventis nec nisi serena nocte; gelando liquorem minui, resolutaque glacie non eundem inveniri modum; varietates colorum figurarumque in nubibus cerni prout admixtus ignis superet aut
- 153 vincatur; LXII. praeterea quasdam proprietates quibusdam locis esse, roscidas aestate Africae noctes, in Italia Locris et in lacu Velino nullo non die adparere arcus, Rhodi et Syracusis numquam tanta nubila obduci ut non aliqua hora sol cernatur; qualia aptius suis referentur locis.

Haec sint dicta de aere.

- 154 LXIII. Sequitur terra, cui uni rerum naturae partium eximia propter merita cognomen indidimus maternas venerationis. sic hominum illa ut caelum dei, quae nos nascentes excipit, natos alit, semelque

^a That is, the water is of larger bulk than the ice was. In fact of course the opposite is true.

in the sky when the sun is low and low when it is high; and smaller but of wider breadth at sunrise or sunset, and narrow but of large circumference at midday. In summer they are not seen during midday, but after the autumn equinox they are seen at any hour; and never more than two are seen at once.

LXI. I observe that the facts as to the other phenomena of the same kind are generally familiar: viz. that hail is produced from frozen rain and snow from the same fluid less solidly condensed, but hoar frost from cold dew; that snow falls during winter but not hail, and hail itself falls more often in the daytime than at night, and melts much faster than snow; that mists do not occur in summer nor in extremely cold weather, nor dew in frosty or very hot or windy weather, and only on fine nights; that liquid is reduced in bulk by freezing, and when ice is thawed the bulk produced is not the same ^a; that variations of colour and shape are seen in the clouds in proportion as the fire mingled with them gains the upper hand or is defeated; LXII. and moreover that particular places have particular special qualities: the nights of Africa are dewy in summer, in Italy rainbows are seen every day at Locri and at the Veline Lake, at Rhodes and Syracuse there is never such a thick curtain of cloud that the sun is not visible at some hour of the day. Such special features will be more suitably related in their places.

So much on the subject of the air.

LXIII. Next comes the earth, the one division of the natural world on which for its merits we have bestowed the venerable title of mother. She belongs to men as the sky belongs to God: she receives us at birth, and gives us nurture after birth, and when once

*Hail, snow,
frost,
rainbows.*

*Mother
Earth.*

editos sustinet semper, novissime complexa gremio iam a reliqua natura abdicatos tum maxime ut mater operiens, nullo magis sacra merito quam quo nos quoque sacros facit, etiam monumenta ac titulos gerens nomenque prorogans nostrum et memoriam extendens contra¹ brevitatem aevi, cuius numen ultimum iam nullis precamur irati grave, tamquam
155 homini. aquae subeunt in imbres, rigescunt in grandines, tumescunt in fluctus, praecipitantur in torrentes; aer densatur nubibus, furit procellis; at haec benigna, mitis, indulgens, ususque mortalium semper ancilla, quae coacta generat, quae sponte fundit, quos odores saporisque, quos sucos, quos tactus, quos colores! quam bona fide creditum faenus² reddit! quae nostra causa alit! pestifera enim animantia, vitali spiritu habente culpam, illi necesse est seminata excipere et genita sustinere, sed in malis generantium noxa est. illa serpentem homine percusso amplius non recipit, poenasque etiam inertium nomine exigit; illa medicas fundit herbas,
156 et semper homini parturit; quin et venena nostri miseritiam instituisse credi potest, ne in taedio vitae fames, mors terrae meritis alienissima, lenta nos consumeret tabe, ne lacerum corpus abrupta dis-

¹ ultra Haupt.

² faenus v.l. om.

^a 'Sit tibi terra gravis.' 'Sit tibi terra levis' was common on gravestones.

^b This oddly inaccurate phrase occurs at V. 24, and in Plautus and Cicero.

^c Cf. infra 158 fin.

^d Cf. XXIX 74.

brought forth she upholds us always, and at the last when we have now been disinherited by the rest of nature she embraces us in her bosom and at that very time gives us her maternal shelter; sanctified by no service more than that whereby she makes us also sacred, even bearing our monuments and epitaphs and prolonging our name and extending our memory against the shortness of time; whose divinity is the last which in anger we invoke to lie heavy^a on those who are now no more, as though we did not know that she is the only element that is never wroth with man. Water rises in mist, freezes into hail, swells in waves, falls headlong in torrents; air becomes thick with clouds and rages with storms; but earth is kind and gentle and indulgent, ever a handmaid in the service of mortals, producing under our compulsion, or lavishing of her own accord, what scents and savours, what juices, what surfaces for the touch, what colours! how honestly she repays the interest lent her!^b what produce she fosters for our benefit! since for living creatures that are noxious the breath of life is to blame—she is compelled to receive them when their seed is sown and to maintain them when they have been born; but their harm lies in the evils of those that generate them.^c When a serpent has stung a man she harbours it no more,^d and she exacts retribution even on the account of the helpless; she produces medicinal herbs, and is ever fertile for man's benefit; nay, even poisons she may be thought to have invented out of compassion for us, lest, when we were weary of life, hunger, the death most alien to earth's beneficence, should consume us with slow decay, lest precipices should scatter in fragments our lacerated body, lest

Earth's
bounty.

pergerent, ne laquei torqueret poena praepostera
 incluso spiritu cui quaereretur exitus, ne in profundo
 quaesita morte sepultura pabulo fieret, ne ferri
 cruciatus scinderet corpus. ita est, miserita genuit
 id cuius facillimo haustu inlibato corpore et cum toto
 sanguine exstingueremur nullo labore, sitientibus
 similes, qualiter defunctos non volucris, non ferae
 attingerent, terraeque servaretur qui sibi ipsi
 157 periisset. verum fateamur: terra nobis malorum
 remedium genuit, nos illud vitae fecimus venenum;
 non enim et ferro, quo carere non possumus, simili
 modo utimur? nec tamen quereremur merito etiamsi
 malefici causa tulisset. adversus unam quippe
 naturae partem ingrati sumus. quas non ad delicias
 quasque non ad contumelias servit homini? in
 maria iacitur, aut ut freta admittamus eroditur,
 aquis, ferro, ligno, igni, lapide, fruge omnibus crucia-
 tur horis, multoque plus ut deliciis quam ut alimen-
 158 tis famuletur nostris. ut¹ tamen quae summa
 patitur atque extrema cute tolerabilia videantur,
 penetramus in viscera auri argentique venas et aeris
 ac plumbi metalla fodientes, gemmas etiam et
 quosdam parvolos quaerimus lapides scrobibus in pro-
 fundum actis, viscera eius extrahimus, ut digito
 gestetur gemma petitur. quot manus atteruntur ut
 unus niteat articulus! si ulli essent inferi, iam pro-

¹ *Sillig*: et.

^a Or 'should be effected by our becoming food,' *sc.* for fishes.

we should be tortured by the perverted punish-
 ment of the noose which imprisons the breath whose
 departure it is seeking; lest if we sought death
 in the deep our burial should serve for fodder^a;
 lest the torture of the steel should cleave our body.
 So is it! in mercy did she generate the potion whereof
 the easiest draught—as men drink when thirsty—<sup>Man's abuse
of her gifts.</sup>
 might painlessly just blot us out, without injury to the
 body or loss of blood, in such wise that when dead
 no birds nor beasts should touch us, and one that had
 perished for himself should be preserved for the earth.
 Let us own the truth: what earth has produced as a
 cure for our ills, we have made into a deadly poison;
 why, do we not also put her indispensable gift
 of iron to a similar use? Nor yet should we have
 any right to complain even if she had engendered
 poison to serve the purpose of crime. In fact in
 regard to one of nature's elements we have no grati-
 tude. For what luxuries and for what outrageous
 uses does she not subserve mankind? She is flung
 into the sea, or dug away to allow us to let in the
 channels. Water, iron, wood, fire, stone, growing
 crops, are employed to torture her at all hours, and
 much more to make her minister to our luxuries
 than our sustenance. Yet in order to make the
 sufferings inflicted on her surface and mere outer
 skin seem endurable, we probe her entrails, digging
 into her veins of gold and silver and mines of copper
 and lead; we actually drive shafts down into the
 depth to search for gems and certain tiny stones; we
 drag out her entrails, we seek a jewel merely to be
 worn upon a finger! How many hands are worn
 away with toil that a single knuckle may shine
 resplendent! If any beings of the nether world

fecto illos avaritiae atque luxuriae cuniculi refodis-
sent! et miramur si eadem ad noxam genuit aliqua?
159 ferae enim, credo, custodiunt illam arcentque
sacrilegas manus; nonne¹ inter serpentes fodimus et
venas auri tractamus cum veneni radicibus? placat-
iore tamen dea utimur ob hoc, quod omnes hi
opulentiae exitus ad scelera caedesque et bella
tendunt, quamque sanguine nostro rigamus insepultis
ossibus tegimus, quibus tamen velut expurgato²
furore tandem ipsa se obducit et scelera quoque
mortalium occultat.

Inter crimina ingrati animi et hoc duxerim quod
160 naturam eius ignoramus. LXIV. est autem figura
prima de qua consensus iudicat. orbem certe dici-
mus terrae, globumque verticibus includi fatemur.
neque enim absoluti orbis est forma in tanta montium
excelsitate, tanta camporum planitie, sed cuius
amplexus, si capita cunctarum³ liniarum compre-
hendantur ambitu, figuram absoluti orbis efficiat—
id quod ipsa rerum natura cogit, non eisdem causis
quas attulimus in caelo. namque in illo cava in se
convexitas vergit et cardini suo, hoc est terrae, undi-
que incumbit, haec ut solida ac conferta adsurgit
intumescenti similis extraque protenditur. mundus
in centrum vergit, at terra exit a centro, inmensum

¹ *v.l.* non.

² *Rackham*: exprobrato.

³ *Ignotus apud Dalecampium*: si cuncta aut si capita.

^a I.e. imaginary radii drawn from the centre to the topmost point of each protuberance on the earth's surface.

existed, assuredly even they would have been dug up
ere now by the burrowings of avarice and luxury!
And can we wonder if earth has also generated some
creatures for our harm? since the wild animals, I
well believe, are her guardians, and protect her from
sacrilegious hands; do not serpents infest our mines,
do we not handle veins of gold mingled with the roots
of poison? Yet that shows the goddess all the kinder
towards us, because all these avenues from which
wealth issues lead but to crime and slaughter and
warfare, and her whom we besprinkle with our blood
we cover with unburied bones, over which neverthe-
less, when at length our madness has been finally
discharged, she draws herself as a veil, and hides even
the crimes of mortals.

I would reckon this too among the crimes of our
ingratitude, that we are ignorant of her nature.
LXIV. But her shape is the first fact about which *The earth's*
men's judgement agrees. We do undoubtedly *conform-*
speak of the earth's sphere, and admit that the globe *ation.*
is shut in between poles. Nor yet in fact do all these
lofty mountains and widely spreading plains com-
prise the outline of a perfect sphere, but a figure whose
circuit would produce a perfect sphere if the ends of
all the lines^a were enclosed in a circumference. This
is the consequence of the very nature of things, it is
not due to the same causes as those we have adduced
in the case of the heaven; for in the heaven the
convex hollow converges on itself and from all sides
rests upon its pivot, the earth, whereas the earth
being a solid dense mass rises like an object swelling,
and expands outward. The world converges to its
centre, whereas the earth radiates outward from its
centre, the ceaseless revolution of the world around

eius globum in formam orbis adsidua circa eam mundi volubilitate cogente.

161 LXV. Ingens hic pugna litterarum¹ contraque volgi: circumfundi terrae undique homines conversisque inter se pedibus stare, et cunctis similem esse caeli verticem,² simili modo ex quacumque parte mediam³ terram⁴ calcari, illo quaerente, cur non decidant contra siti, tamquam non ratio praesto sit ut nos non decidere mirentur illi. intervenit sententia quamvis indocili probabilis turbae, inaequali globo, ut si sit figura pineae nucis, nihilominus terram 162 undique incoli. Sed quid hoc refert alio miraculo exoriente, pendere ipsam ac non cadere nobiscum?—ceu spiritus vis, mundo praesertim inclusi, dubia sit, aut possit cadere natura repugnante et quo cadat negante! nam sicut ignium sedes non est nisi in ignibus, aquarum nisi in aquis, spiritus nisi in spiritu, sic terrae arcentibus cunctis nisi in se locus non est. globum tamen effici mirum est in tanta planitie maris camporumque. cui sententiae adest Dicaearchus, vir in primis eruditus, regum cura permensus montes, ex quibus altissimum prodidit Pelium MCCL passuum ratione perpendiculari, nullam esse eam portionem

¹ litterarum? *Rackham.*

² *v.l.* verticem caeli *aut* verticem.

³ *v.l.* media. ⁴ terram *add.* *Rackham.*

^a *Passus* = 2 *gradus* = 5 Roman feet, 1·617 yards, making Pelion's height as stated here over 6,000 English feet. The *Encyclopaedia Britannica* gives it as 5,340 feet. Pliny overstates the Alpine heights fantastically.

her forcing her immense globe into the shape of a sphere.

LXV. Here there is a mighty battle between *Earth spherical.* learning on one side and the common herd on the other: the theory being that human beings are distributed all round the earth and stand with their feet pointing towards each other, and that the top of the sky is alike for them all and the earth trodden under foot at the centre in the same way from any direction, while ordinary people enquire why the persons on the opposite side don't fall off—just as if it were not reasonable that the people on the other side wonder that we do not fall off. There is an intermediate theory that is acceptable even to the unlearned crowd—that the earth is of the shape of an irregular globe, resembling a pine cone, yet nevertheless is inhabited all round. But what is the good of this theory when there arises another marvel, that the earth herself hangs suspended and does not fall and carry us with it? As if forsooth there were any doubt about the force of breath, especially when shut up inside the world, or as if it were possible for the earth to fall when nature opposes, and denies it any place to fall to! For just as the sole abode of fires is in the element of fire, and of waters in water, and of breath in breath, so earth, barred out by all the other elements, has no place except in itself. Yet it is surprising that with this vast level expanse of sea and plains the resulting formation is a globe. This view has the support of Dicaearchus, a *savant* of the first rank, who with the support of royal patrons took the measurement of mountains, and published that the highest of them was Pelion, with an altitude of 1250 paces,^a inferring that this was no portion

universae rotunditatis colligens. mihi incerta haec videtur coniectatio, haud ignaro quosdam Alpium vertices longo tractu nec brevior quinquaginta milibus passuum adsurgere.

- 163 Sed volgo maxima haec pugna est, si coactam in verticem aquarum quoque figuram credere cogatur. atqui non aliud in rerum natura adspectu manifestius. namque et dependentes ubique guttae parvis globantur orbibus et pulveri inlatae frondiumque lanugini inpositae absoluta rotunditate cernuntur, et in poculis repletis media maxime tument, quae propter subtilitatem umoris mollitiamque in se residentem ratione facilius quam visu deprehenduntur; idque etiam magis mirum, in poculis repletis addito umore minimo circumfluere quod supersit, contra evenire ponderibus additis ad vicenos saepe denarios, scilicet quia intus recepta liquorem in verticem attollant, at cumulo eminenti infusa
- 164 delabantur. eadem est causa propter quam e navibus terra non cernatur e navium malis conspicua, ac procul recedente navigio, si quid quod fulgeat religetur in mali cacumine, paulatim descendere videatur et postremo occultetur. denique oceanus, quem fatemur ultimum, quamvis alia figura cohaereret atque non decideret nullo ultra margine includente? id ipsum ad miraculum redit, quoniam modo, etiamsi

* I.e. a negligible fraction of the earth's diameter, a negligible protrusion.

of the earth's general sphericity.^a To me this seems a questionable guess, as I know that some peaks of the Alps rise to a great height, not less than 50,000 paces.

But what the crowd most debates is if it must believe that the conformation of the waters also rises in a curve. Nevertheless nothing else in the natural world is more visibly manifest. For (1) hanging drops of liquid always take the shape of small round globes; (2) when dropped on dust or placed on the downy surface of leaves they are seen to be absolutely spherical; (3) in goblets when filled the surface curves upward most at the centre, though owing to the transparency of the liquid and its fluidity tending to find its own level this is more easily discovered by theory than by observation; and (4) a still more remarkable fact is that when a very little additional liquid is poured into a cup that has already been filled the surplus overflows, but the opposite happens when weighty solids, often as many as 20 coins, are put into it, presumably because these pass inside the liquid and raise its surface to a peak, whereas liquids poured on to the upward curving surface slip off. (5) The same cause explains why the land is not visible from the deck of a ship when in sight from the masthead; and why as a vessel passes far into the distance, if some shining object is tied to the top of the mast it appears slowly to sink and finally it is hidden from sight. Lastly (6) what other conformation could have caused the ocean, which we acknowledge to be at the extreme outside, to cohere and not fall away, if there is no boundary beyond to enclose it? The very question as to how, although the sea is globular in shape, its edge does

Spherical surface of the oceans.

globetur, extremum non decidat mare. contra quod, ut sint plana maria et qua videntur figura, non posse id accidere magno suo gaudio magnaue gloria inventores Graeci subtilitate geometrica docent.

165 namque cum e sublimi in inferiora aquae ferantur et sit haec natura earum confessa, nec quisquam dubitet in litore ullo accessisse eas quo longissime devexitas passa sit, procul dubio adparere quo quid humilior sit propius a centro esse terrae, omnesque linias quae emittantur ex eo ad proximas aquas breviores fieri quam quae ad extremum mare a primis aquis; ergo totas omnique ex parte aquas vergere in centrum, ideoque non decidere quoniam in interiora nitantur.

166 LXVI. Quod ita formasse artifex naturae¹ credi debet, ut, cum terra arida et sicca constare per se ac sine umore non posset, nec rursus stare aqua nisi sustinente terra, mutuo inplexu iungerentur, hac sinus pendente, illa vero permeante totam intra extra infra² supra venis ut vinculis discurrentibus, atque etiam in summis iugis erumpente, quo spiritu acta et terrae pondere expressa siphonum modo emicat, tantumque a periculo decidendi abest ut in summa quaeque et altissima exsiliat. qua ratione mani-

¹ *v.l.* natura.

² *infra add. edd.*

not fall away, itself ranks with the marvellous. On the other side the Greek investigators, greatly to their delight and to their glory, prove by subtle mathematical reasoning that it cannot possibly be the case that the seas are really flat and have the shape that they appear to have. For, they argue, while it is the case that water travels downward from an elevation, and this is its admitted nature, and nobody doubts that the water on any coast has reached the farthest point allowed by the slope of the earth, it is manifest beyond doubt that the lower an object is the nearer it is to the centre of the earth, and that all the lines drawn from the centre to the nearest bodies of water are shorter than those drawn from the edge of these waters to the farthest point in the sea: it therefore follows that all the water from every direction converges towards the centre, this pressure inward being the cause of its not falling off.

LXVI. The reason for this formation must be thought to be the inability of earth when absolutely dry to cohere of itself and without moisture, and of water in its turn to remain still without being held up by earth; the intention of the Artificer of nature must have been to unite earth and water in a mutual embrace, earth opening her bosom and water penetrating her entire frame by means of a network of veins radiating within and without, above and below, the water bursting out even at the tops of mountain ridges, to which it is driven and squeezed out by the weight of the earth, and spurts out like a jet of water from a pipe, and is so far from being in danger of falling down that it leaps upward to all the loftiest elevations. This theory shows clearly why the seas

Coherence of earth and water.

festum est quare tot fluminum cotidiano accessu maria non crescant. est igitur in toto suo globo tellus medio ambitu praecineta circumfluo mari, nec argumentis hoc investigandum, sed iam experimentis cognitum.

- 167 LXVII. A Gadibus columnisque Herculis Hispaniae et Galliarum circuitu totus hodie navigatur occidentis. septentrionalis vero oceanus maiore ex parte navigatus est auspiciis divi Augusti Germaniam classe circumvecta ad Cimbrorum promunturium et inde immenso mari prospecto aut fama cognito Scythicam ad plagam et umore nimio rigentia. propter quod minime verisimile est illic maria deficere ubi umoris vis superet. iuxta vero ab ortu ex Indico mari sub eodem sidere pars tota vergens in Caspium mare pernavigata est Macedonum armis Seleuco atque Antiocho regnantibus, qui et Seleucida et Antiochida
168 ab ipsis appellari voluere. et circa Caspium multa oceani litora explorata parvoque brevius quam totus hinc aut illinc septentrio eremigatus, ut iam¹ coniecturae locum sic quoque non relinquat ingens argumentum paludis Maeoticae, sive ea illius oceani sinus est, ut multos adverte credidisse, sive angusto discreti situ restagnatio. alio latere Gadium ab eodem occidente magna pars meridiani sinus ambitu Mauretaniae

¹ *Mayhoff*: tamen.

^a Cape Skagen, Jutland.

^b The Caspian Sea was believed to have an outlet by a Strait into the Outer Ocean, which was thought to flow not far north of the Himalayas and South Russia.

do not increase in bulk with the daily accession of so many rivers. The consequence is that the earth at every point of its globe is encircled and engirdled by sea flowing round it, and this does not need theoretical investigation, but has already been ascertained by experience.

LXVII. Today the whole of the West is navigated from Cadiz and the Straits of Gibraltar all round Spain and France. But the larger part of the Northern Ocean was explored under the patronage of his late Majesty Augustus, when a fleet sailed round Germany to the promontory of the Cimbri,^a and thence seeing a vast sea in front of them or learning of it by report, reached the region of Scythia and localities numb with excessive moisture. On this account it is extremely improbable that there is no sea in those parts, as there is a superabundance of the moist element there. But next, on the Eastward side, the whole quarter under the same star stretching from the Indian Ocean to the Caspian Sea^b was navigated throughout by the Macedonian forces in the reigns of Seleucus and Antiochus, who desired that it should be called both Seleucis and Antiochis after themselves. And many coasts of Ocean round the Caspian have been explored, and very nearly the whole of the North has been completely traversed from one side to the other by galleys, so that similarly also there is now overwhelming proof, leaving no room for conjecture, of the existence of the Maeotic Marsh, whether it be a gulf of that Ocean, as I notice many have believed, or an overflow from it from which it is separated off by a narrow space. On the other side of Cadiz, from the same Western point, a great part of the Southern gulf is navigated today in the

Circumnavigation of the earth.

navigatur hodie. maiorem quidem eius partem et orientis victoriae magni Alexandri lustravere usque in Arabicum sinum, in quo res gerente C. Caesare Augusti filio signa navium ex Hispaniensibus nau-
 169 fragiis feruntur agnita. et Hanno Carthaginis potentia florente circumvectus a Gadibus ad finem Arabiae navigationem eam prodidit scripto, sicut ad extera Europae noscenda missus eodem tempore Himilco. praeterea Nepos Cornelius auctor est Eudoxum quendam sua aetate, cum Lathyrum regem fugeret, Arabico sinu egressum Gades usque pervectum; multoque ante eum Caelius Antipater vidisse se qui navigasset ex Hispania in Aethiopiam
 170 commercii gratia. idem Nepos de septentrionali circuitu tradit Quinto Metello Celeri, Afrani in consulatu collegae sed tum Galliae proconsuli, Indos a rege Sueborum dono datos, qui ex India commercii causa navigantes tempestatibus essent in Germaniam abrepti. sic maria circumfusa undique dividuo globo partem orbis auferunt nobis nec inde huc nec hinc illo pervio tractu. quae contemplatio apta detegendae mortalium vanitati poscere videtur ut totum hoc quicquid est in quo singulis nihil satis est ceu subiectum oculis quantum sit ostendam.

171 LXVIII. Iam primum in dimidio computari videtur, tamquam nulla portio ipsi decidatur¹ oceano, qui toti² circumdatus medio et omnis ceteras fundens

¹ *v. l.* decidat, decedat. ² *Rackham*: toto.

^a The son of Agrippa, adopted by Augustus.

^b Both these statements are of course untrue.

^c We know from Strabo that this statement about Eudoxus is erroneous. ^d I.e. round S. Africa.

^e I.e. dividing us from another land-mass (now known as North and South America) which was assumed to exist on the other side of the world.

circuit of Mauretania. Indeed the greater part of it Alexander the Great's eastern conquests also explored as far as the Arabian gulf; in which, when Augustus's son Gaius Caesar^a was operating there, it is said that figureheads of ships from Spanish wrecks were identified. Also when the power of Carthage flourished, Hanno sailed round from Cadiz to the extremity of Arabia,^b and published a memoir of his voyage, as did Himilco when despatched at the same date to explore the outer coasts of Europe. Moreover we have it on the authority of Cornelius Nepos that a certain contemporary of his named Eudoxus when flying from King Lathyrus emerged from the Arabian Gulf and sailed right round to Cadiz^c; and much before him Caelius Antipater states that he had seen someone who had gone on a trading voyage from Spain to Ethiopia.^d Nepos also records as to the northern circuit that Quintus Metellus Celer, colleague of Afranius in the consulship but at the time pro-consul of Gaul, received from the King of the Swabians a present of some Indians, who on a trade voyage had been carried off their course by storms to Germany. Thus there are seas encircling the globe on every side and dividing it in two, so robbing us of half the world,^e since there is no region affording a passage from there to here or from here to there. This reflexion serves to expose the vanity of mortals, and appears to demand that I should display to the eye and exhibit the extent of this whole indefinite region in which men severally find no satisfaction.

LXVIII. In the first place it is apparently reckoned as forming one half of the globe—just as if
 no part were cut off for the ocean itself, which sur-
 rounding and encircling the whole of it, and pouring
Portion of the earth habitable by man.

recipiensque aquas, et quicquid exit in nubes ac sidera ipsa tot ac tantae magnitudinis pascens, quo tandem amplitudinis spatio credetur habitare? inproba et
 172 infinita debet esse tam vastae molis possessio. adde quod ex relicto plus abstulit caelum. nam cum sint eius quinque partes, quas vocant zonas, infesto rigore et aeterno gelu premitur omne quicquid est subiectum duabus extremis utrimque circa vertices, hunc qui trionum septem vocatur eumque qui adversus illi austrinus appellatur. perpetua caligo utrobique et alieno molliorum siderum adpectu maligna ac pruina tantum albicans lux. media vero terrarum, qua solis orbita est, exusta flammis et cremata comminus vapore torretur. circa duae tantum inter exustam et rigentes temperantur, eaeque ipsae inter se non perviae propter incendium sideris.

173 Ita terrae tres partes abstulit caelum. oceani rapina in incerto est; sed et relicta nobis una portio haud scio an etiam in maiore damno sit, idem siquidem oceanus infusus in multos, ut dicemus, sinus adeo vicino accessu interna maria adlatrat ut centum quindecim milibus passuum Arabicus sinus distet ab Aegyptio mari, Caspius vero CCCLXXV milibus a Pontico, idem interfusus intra per tot maria quibus Africam Europam Asiam dispescit, quantum terrarum occupat?
 174 at? Computetur etiamnum¹ mensura tot flumi-

¹ *Mayhoff*: etiam nunc.

^a I.e. especially the sun.

^b Books III foll.

^c Cf. § 167 note.

forth and reabsorbing the waters and pasturing and all the moisture that goes to form the clouds, the stars themselves with all their numbers and their mighty size, can be supposed to occupy a space—of what extent, pray? The freehold owned by that mighty mass is bound to be enormous—without limit! Add that of what is left more than half is taken by the sky. For this has five divisions called zones, and all that lies beneath the two outermost zones that surround the poles at either end—both the pole named from the Seven Oxen and the one opposite to it called after Auster—is all crushed under cruel frost and everlasting cold. In both regions perpetual mist prevails, and a light that the invisibility of the milder stars^a renders niggardly and that is only white with hoarfrost. But the middle portion of the lands, where the sun's orbit is, is scorched by its flames and burnt up by the proximity of its heat: this is the torrid zone. There are only two temperate zones between the torrid one and the frozen ones, and these have no communication with each other because of the fiery heat of the heavenly body.

Thus the sky has stolen three quarters of the earth. The extent of the trespass of ocean is unascertained; but even the one portion left to us suffers perhaps an even greater loss, inasmuch as the same ocean, spreading out, as we shall describe^b, into a number of bays, advances with its threatening roar so close to the inner seas that there is only a distance of 115 miles between the Arabian Gulf and the Egyptian Sea and of 375 between the Caspian and the Black Sea^c; and also with its inner channels through so many seas whereby it sunders Africa, Europe and Asia, it occupies—what area of the land? Calculate more-

Climatic limits.

Encroachment of water.

num, tantarum paludium, addantur et lacus, stagna, iam elata in caelum ac ardua adspectu quoque iuga, iam silvae vallesque praeruptae et solitudines et mille e¹ causis deserta; detrahantur hae tot portiones terrae, immo vero, ut plures tradidere, mundi puncto (neque enim aliud est terra in universo): haec est materia gloriae nostrae, haec sedes, hic honores gerimus, hic exercemus imperia, hic opes cupimus, hic tumultuamur humanum genus, hic instauramus bella etiam civilia mutisque caedibus
 175 laxiorem facimus terram! et ut publicos gentium furores transeam, haec in qua conterminos pellimus furtoque vicini caespitem nostro solo adfodimus, ut qui latissime rura metatus fuerit ultraque famam exegerit adcolas quota terrarum parte gaudeat, vel cum ad mensuram avaritiae suae propagaverit, quam tandem portionem eius defunctus obtineat!

176 LXIX. Mediam esse terram mundi totius haut dubiis constat argumentis, sed clarissimo aequinocti paribus horis. nam nisi in medio esset, aequales dies noctesque habere non posse deprehendere est,² dioptraeque vel maxime confirmant, cum aequinoctiali tempore ex eadem linea ortus occasusque cernatur, solstitiali exortus per suam lineam, brumali

¹ e add. Rackham.

² est Mayhoff: et.

^a The Romans divided the periods from sunrise to sunset and from sunset to sunrise each into twelve hours, varying in length with the seasons.

over the dimensions of all those rivers and vast swamps, add also the lakes and pools, and next the ridges too that rise into the heaven and are precipitous even to the eye, next the forests and steep glens, and the deserts and areas for a thousand reasons left deserted; subtract all these portions from the earth or rather from this pin-prick, as the majority of thinkers have taught, in the world—for in the whole universe the earth is nothing else: and this is the substance of our glory, this is its habitation, here it is that we fill positions of power and covet wealth, and throw mankind into an uproar, and launch even civil wars and slaughter one another to make the land more spacious! And to pass over the collective insanities of the nations, this is the land in which we expel the tenants next to us and add a spade-full of turf to our own estate by stealing from our neighbour's—to the end that he who has marked out his acres most widely and banished his neighbours beyond all record may rejoice in owning—how small a fraction of the earth's surface? or, when he has stretched his boundaries to the full measure of his avarice, may still retain—what portion, pray, of his estate when he is dead?

LXIX. That the earth is at the centre of the universe is proved by irrefragable arguments, but the clearest is the equal hours of day and night^a at the equinox. For if the earth were not at the centre, it can be realized that it could not have the days and nights equal; and binoculars confirm this very powerfully, since at the season of the equinox sunrise and sunset are seen on the same line, whereas sunrise at midsummer and sunset at midwinter fall

Geocentric theory.

occasus. quae accidere nullo modo possent nisi in centro sita esset.¹

177 LXX. Tres autem circuli supra dictis zonis inplexi inaequalitates temporum distingunt, solstitialis a parte signiferi excelsissima nobis ad septentrionalem plagam versus, contraque ad alium polum brumalis, item medio ambitu signiferi orbis incedens aequinoctialis.

LXXI. Reliquorum quae miramur causa in ipsius terrae figura est, quam globo similem esse² et cum ea aquas iisdem intellegitur argumentis. sic enim fit haut dubie ut nobis septentrionalis plagae sidera numquam occidant, contra meridianae numquam oriantur, rursusque haec illis non cernantur attollente
178 se contra medios visus terrarum globo. Septentriones non cernit Trogodytice et confinis Aegyptus, nec Canopum Italia et quem vocant Berenices Crinem item quem sub divo Augusto cognominavere Caesaris Thronon, insignes ibi stellas. adeoque manifesto adsurgens fastigium curvatur ut Canopus quartam fere partem signi unius supra terram eminere Alexandriae intuentibus videatur, eadem a Rhodo terram quodammodo ipsam stringere, in Ponto omnino non cernatur, ubi maxime sublimis Septentrio. idem a Rhodo absconditur, magisque Alexandriae, in Arabia Novembri mense prima vigilia occultus secunda se

¹ *v.l. om.* esset.

² esse *add. Rackham.*

^a Roughly Abyssinia and Somaliland.

on a line of their own. These things could not occur without the earth's being situated at the centre.

LXX. But the three circles intertwined between *The seasons.* the zones aforesaid are the cause of the differences of the seasons: the Tropic of Cancer on the side of the highest part of the zodiac to the northward of us, and opposite to it the Tropic of Capricorn towards the other pole, and also the equator that runs in the middle circuit of the zodiac.

LXXI. The cause of the remaining facts that *Geography and astronomy.* surprise us is found in the shape of the earth itself, which together with the waters also the same arguments prove to resemble a globe. For this is undoubtedly the cause why for us the stars of the northern region never set and their opposites of the southern region never rise, while on the contrary these northern stars are not visible to the antipodes, as the curve of the earth's globe bars our view of the tracts between. Cave-dweller Country^a and Egypt which is adjacent to it do not see the Great and Little Bear, and Italy does not see Canopus and the constellation called Berenice's Hair, also the one that in the reign of his late Majesty Augustus received the name of Caesar's Throne, constellations that are conspicuous there. And so clearly does the rising vault curve over that to observers at Alexandria Canopus appears to be elevated nearly a quarter of one sign above the earth, whereas from Rhodes it seems practically to graze the earth itself, and on the Black Sea, where the North Stars are at their highest, it is not visible at all. Also Canopus is hidden from Rhodes, and still more from Alexandria; in Arabia in November it is hidden during the first quarter of the

ostendit, in Meroe solstitio vesperi paulisper adparet paucisque ante exortum Arcturi diebus pariter cum
 179 die cernitur. navigantium haec maxime cursus deprehendunt, in alia adverso in alia pronò mari, subitoque conspicuis atque ut e freto emergentibus quae in anfractu pilae latuere sideribus. neque enim, ut dixere aliqui, mundus hoc polo excelsiore se attollit, aut ¹ undique cernerentur haec sidera; verum haec eadem quibusque proximis sublimiora creduntur eademque demersa longinquis, utque nunc sublimis in deictu positus videtur hic vertex, sic in illam terrae devexitatem transgressis illa se attollunt residentibus quae hic excelsa fuerant, quod nisi in figura pilae accidere non posset.

180 LXXII. Ideo defectus solis ac lunae vespertinos orientis incolae non sentiunt, nec matutinos ad occasum habitantes, meridianos vero serius nobis illi. apud Arbelam magni Alexandri victoria luna defecisse noctis secunda hora est prodita, eademque in Sicilia exoriens. solis defectum Vipstano et Fonteio coss., qui fuere ante paucos annos, factum pridie kalendas Maias Campania hora diei inter septimam et octavam sensit, Corbulo dux in Armenia inter horam diei decimam et undecimam prodidit visum, circuitu globi alia aliis detegente et occultante. quod si plana

¹ ita ut *Mayhoff*.

^a As a matter of fact the eclipse was on Sept. 20, 331 B.C., eleven days before the battle.

^b A.D. 59.

night and shows itself in the second; at Meroe it appears a little in the evening at midsummer and a few days before the rising of Arcturus is seen at day-break. These phenomena are most clearly disclosed by the voyages of those at sea, the sea sloping upward in the direction of some and downward in the direction of others, and the stars that were hidden behind the curve of the ball suddenly becoming visible as it were rising out of the sea. For it is not the fact, as some have said, that the world rises up at this higher pole—or else these stars would be visible everywhere; but these stars are believed to be higher the nearer people are to them, while they seem low to those far away, and just as at present this pole seems lofty to those situated on the declivity, so when people pass across to yonder downward slope of the earth those stars rise while the ones that here were high sink, which could not happen except with the conformation of a ball.

LXXII. Consequently inhabitants of the East *Local visibility eclipses.* do not perceive evening eclipses of the sun and moon, nor do those dwelling in the West see morning eclipses, while the latter see eclipses at midday later than we do. The victory of Alexander the Great is said to have caused an eclipse of the moon at Arbela at 8 p.m.^a while the same eclipse in Sicily was when the moon was just rising. An eclipse of the sun that occurred on April 30 in the consulship^b of Vipstanus and Fonteius a few years ago was visible in Campania between 1 and 2 p.m. but was reported by Corbulo commanding in Armenia as observed between 4 and 5: this was because the curve of the globe discloses and hides different phenomena for different localities. If the earth were

esset terra, simul omnia adparerent cunctis, noctesque non fierent inaequales, nam aequae aliis quam in medio sitis paria duodecim horarum intervalla cernerentur, quae nunc non in omni parte simili modo congruunt.

181 LXXIII. Ideo nec nox diesque, quamvis eadem, toto orbe simul est oppositu globi noctem aut ambitu diem adferente. multis hoc cognitum experimentis, in Africa Hispaniaque turrium Hannibalis, in Asia vero propter piraticos terrores simili specularum praesidio excitato, in quis praenuntios ignes sexta hora diei accensos saepe conpertum est tertia noctis a tergo ultimis visos. eiusdem Alexandri cursor Philonides ex Sicyone Elin mille et ducenta stadia novem diei confecit horis, indeque, quamvis declivi itinere, tertia noctis hora remensus est saepius. causa, quod eunti cum sole iter erat, eundem remeans obvium contrario praetervertebat occursum. qua de causa ad occasum navigantes quamvis brevissimo die vincunt spatia nocturnae navigationis ut solem ipsum comitantes.

182 LXXIV. Vasaque horoscopica non ubique eadem sunt usui, in trecenis stadiis, aut ut longissime in quingentis, mutantibus semet umbris solis. itaque umbilici (quem gnomonem appellant) umbra in Aegypto meridiano tempore aequinocti die paulo

^a Cf. VII 20.

^b Starting at daybreak, i.e. took 15 hours home as against 9 hours out. Taking the *mille passuum* of 8 stades (see *D. Ant. s.vv.*) at $\frac{1}{4}$ of an English mile, we get for the outward journey a pace of just over 15 miles an hour. But perhaps the length of the route is overestimated at 1200 stades, about 136 miles, as the distance from Sicyon to Elis measures only about 80 miles in a straight line on the map. Elis lies higher

flat, all would be visible to all alike at the same time; also the nights would not vary in length, because corresponding periods of 12 hours would be visible equally to others than those at the equator, periods that as it is do not exactly correspond in every region alike.

LXXIII. Consequently also although night and day are the same thing all over the world, it is not night and day at the same time all over the world, the intervention of the globe bringing night or its revolution day. This has been discovered by many experiments—that of Hannibal's towers in Africa and Spain, and in Asia when piratical alarms prompted the precaution of watchtowers of the same sort, warning fires lit on which at noon were often ascertained to have been seen by the people farthest to the rear at 9 p.m. Alexander above mentioned had a runner named Philonides ^a who did the 1200 stades from Sicyon to Elis in 9 hours from sunrise and took till 9 p.m.^b for the return journey, although the way is downhill; this occurred repeatedly. The reason was that going his way lay with the sun but returning he was passing the sun as it met him travelling in the opposite direction. For this reason ships sailing westward beat even in the shortest day the distances they sail in the nights, because they are going with the actual sun.

LXXIV. Travellers' sundials are not the same for reference everywhere, because the shadows thrown by the sun as they alter alter the readings at every 300 or at farthest 500 stades. Consequently in Egypt at midday on the day of the equinox the

above sea-level than Sicyon, but only the latter part of the return journey can be described as downhill.

Sunrise and sunsets vary with longitude.

Sun's altitude varies with latitude.

plus quam dimidiam gnomonis mensuram efficit, in urbe Roma nona pars gnomonis deest umbrae, in oppido Ancona superest quinta tricesima, in parte Italiae quae Venetia appellatur iisdem horis umbra gnomoni par fit.

- 183 LXXV. Simili modo tradunt in Syene oppido, quod est supra Alexandriam quinque milibus stadiorum, solstiti die medio nullam umbram iaci, puteumque eius experimenti gratia factum totum inluminari, ex quo adparere tum solem illi loco supra verticem esse; quod et in India supra flumen Hypasim fieri tempore eodem Onesicritus scribit. constatque in Berenice urbe Trogodytarum, et inde stadiis quattuor milibus DCCCXX in eadem gente Ptolemaide oppido, quod in margine rubri maris ad primos elephantorum venatus conditum est, hoc idem ante solstitium quadragenis quinque diebus totidemque postea fieri, et
 184 per eos XC dies in meridiem umbras iaci. rursus in Meroe (insula haec caputque gentis Aethiopum quinque milibus stadium a Syene in amne Nilo habitatur) bis anno absumi umbras, sole duodevicesimam tauri partem et quartamdecimam leonis tunc obtinente. in Indiae gente Oretum mons est Maleus nomine iuxta quem umbrae aestate in austrum, hieme in septentrionem iaciuntur; quindecim tantum noctibus ibi apparet septentrio. in eadem India Patalis, celeberrimo portu, sol dexter oritur, umbrae
 185 in meridiem cadunt. septentrionem ibi Alexandro morante adnotatum prima tantum parte noctis

shadow of the pin or 'gnomon' measures a little more than half the length of the gnomon itself, whereas in the city of Rome the shadow is $\frac{1}{5}$ th shorter than the gnomon, at the town of Ancona $\frac{1}{35}$ th longer, and in the district of Italy called Venezia the shadow is equal to the gnomon, at the same hours.

LXXV. Similarly it is reported that at the town of Syene, 5000 stades South of Alexandria, at noon in midsummer no shadow is cast, and that in a well made for the sake of testing this the light reaches to the bottom, clearly showing that the sun is vertically above that place at the time; and this is stated in the writings of Onesicritus also to occur at the same time in India South of the river Hypasis.^a It is also stated that in the Cave-dwellers' city of Berenice, and 4820 stades away at the town of Ptolemais in the same tribe, which was founded on the shore of the Red Sea for the earliest elephant hunts, the same thing occurs 45 days before and 45 days after midsummer, and during that period of 90 days the shadows are thrown southward. Again in Meroe—this is an inhabited island in the river Nile 5000 stades from Syene, and is the capital of the Aethiopian race—the shadows disappear twice a year, when the sun is in the 18th degree of Taurus and in the 14th of Leo. There is a mountain named Maleus in the Indian tribe of the Oretes, near which shadows are thrown southward in summer and northward in winter; the northern constellation is visible there on only 15 nights. Also in India at the well-known port of Patala the sun rises on the right and shadows fall southward. It was noticed when Alexander was staying at this place that the Great and Little Bears were visible only in the early part of the

Stars and latitude.

^a The Beas.

adspici. Onesicritus, dux eius, scripsit quibus in locis Indiae umbrae non sint septentrionem non conspici, et ea loca appellari ascia, nec horas dinumerari ibi. LXXVI. At in tota Trogodytice umbras bis quadraginta quinque diebus in anno Eratosthenes in contrarium cadere prodidit.

- 186 LXXVII. Sic fit ut vario lucis incremento in Meroe longissimus dies XII horas aequinoctiales et octo partes unius horae colligat, Alexandriae vero XIV horas, in Italia XV, in Britannia XVII, ubi aestate lucidae noctes haut dubie repromittunt¹ id quod cogit ratio credi, solstiti diebus accedente sole propius verticem mundi angusto lucis ambitu subiecta terrae continuos dies habere senis mensibus, 187 noctesque e diverso ad brumam remoto. quod fieri in insula Thyle Pytheas Massiliensis scribit sex dierum navigatione in septentrionem a Britannia distante, quidam vero et in Mona, quae distat a Camaloduno Britanniae oppido circiter ducentis milibus, adfirmant.

LXXVIII. Umbrarum hanc rationem et quam vocant gnomonicen invenit Anaximenes Milesius, Anaximandri (de quo diximus) discipulus, primusque horologium quod appellant sciothericon Lacedaemone ostendit.

- 188 LXXIX. Ipsum diem alii aliter observavere, Babylo ni inter duos solis exortus, Athenienses inter

¹ dubie se promittunt *Mayhoff*, dubitare promittunt *Dellefsen*.

^a This is inaccurate, as are other points in this passage.

^b I.e. towards the South.

^c I.e. all between the vernal and the autumnal equinox. Cf. IV. xx.

night. Alexander's guide Onesicritus wrote that this constellation is not visible at the places in India where there are no shadows, and that these places are called Shadeless, and no reckoning is kept of the hours there. LXXVI. But according to Eratosthenes in the whole^a of Cave-dweller Country on 90 days once a year shadows fall the wrong way.^b

LXXVII. Thus it comes about that owing to the varied lengthening of daylight the longest day covers $12\frac{8}{9}$ equinoctial hours at Meroe, but 14 hours at Alexandria, 15 in Italy, and 17 in Britain, where the light nights in summer substantiate what theory compels us to believe, that, as on summer days^c the sun approaches nearer to the top of the world, owing to a narrow circuit of light the underlying parts of the earth have continuous days for 6 months at a time, and continuous nights when the sun has withdrawn in the opposite direction towards winter. Pytheas of Marseilles writes that this occurs in the island of Thule,^d 6 days' voyage N. from Britain, and some declare it also to occur in the Isle of Anglesea, which is about 200 miles^e from the British town of Colchester.

LXXVIII. This theory of shadows and the science called gnomonics was discovered by Anaximenes of Miletus, the pupil of Anaximander of whom we have spoken; he first exhibited at Sparta the time-piece they call 'Hunt-the-Shadow.'^{The first sundial.}

LXXIX. The actual period of a day has been differently kept by different people: the Babylonians count the period between two sunrises, the Athenians^{Day variously reckoned.}

^d Now thought to be N.W. Norway.

^e I.e. by the Roman Road from Colchester, the capital of the province, by Grantchester or Chesterton to Chester.

duos occasus, Umbri a meridie ad meridiem, vulgus omne a luce ad tenebras, sacerdotes Romani et qui diem diffiniere civilem, item Aegypti et Hipparchus, a media nocte in mediam. minora autem intervalla esse lucis inter occasus et¹ ortus solis iuxta solstitium² quam aequinoctia apparet quia positio signiferi circa media sui obliquior est, iuxta solstitium autem rector.

189 LXXX. Contexenda sunt his caelestibus nexa causis. namque et Aethiopas vicini sideris vapore torrerit adustisque similis gigni barba et capillo vibrato non est dubium, et adversa plaga mundi candida atque glaciali cute esse gentes flavis promissis³ crinibus, trucis vero ex caeli rigore has, illas mobilitate sapientes; ipsoque crurum argumento illis in supera sucum revocari natura vaporis, his in inferas partes depelli umore deciduo; hic graves feras, illic varias effigies animalium provenire et maxime alitum [in multas figuras gigni⁴ volucres⁵];
190 nisus, hic umoris alimento; medio vero terrae salubri utrimque mixtura fertiles ad omnia tractus, modicos corporum habitus magna et in colore temperie, ritus

¹ occasus et add. Rackham.

² Rackham: solstitia.

³ Rackham: promissa.

⁴ v.l. igni.

⁵ secl. Detlefsen.

^a I.e. the summer solstice, as often.

^b Cf. Galen *de temperamentis* III vi 72 εἰ μὲν ὁμαλῶς ἔχει τὸ σῶμα τῆς κράσεως, οἷς μὲν ἰσχνὰ τὰ σκέλη ξηροὶ πάντως εἶσιν ὑγροὶ δὲ οἷς παχέα.

that between two sunsets, the Umbrians from midday to midday, the common people everywhere from dawn to dark, the Roman priests and the authorities who fixed the official day, and also the Egyptians and Hipparchus, the period from midnight to midnight. But it is obvious that the breaks in daylight between sunset and sunrise are smaller near the solstice^a than at the equinoxes, because the position of the zodiac is more slanting around its middle points but straighter near the solstice.

LXXX. We must deal next with the results connected with these heavenly causes. For it is beyond question that the Ethiopians are burnt by the heat of the heavenly body near them, and are born with a scorched appearance, with curly beard and hair, and that in the opposite region of the world the races have white frosty skins, with yellow hair that hangs straight; while the latter are fierce owing to the rigidity of their climate but the former wise because of the mobility of theirs; and their legs^b themselves prove that with the former the juice is called away into the upper portions of the body by the nature of heat, while with the latter it is driven down to the lower parts by falling moisture; in the latter country dangerous wild beasts are found, in the former a great variety of animals and especially of birds; but in both regions men's stature is high, owing in the former to the pressure of the fires and in the latter to the nourishing effect of the damp; whereas in the middle of the earth, owing to a healthy blending of both elements, there are tracts that are fertile for all sorts of produce, and men are of medium bodily stature, with a marked blending even in the matter of complexion; customs are

Climate and racial characteristics.

molles, sensus liquidos, ingenia fecunda totiusque naturae capacis, isdem imperia, quae numquam extimis gentibus fuerint, sicut ne illae quidem his paruerint avolsae ac pro immanitate¹ naturae urgulentis illas solitariae.

191 LXXXI. Babyloniorum placita et motus terrae hiatusque qua cetera omnia siderum vi existimant fieri, sed illorum trium quibus fulmina adsignant, fieri autem meantium cum sole aut congruentium et maxime circa quadrata mundi. praeclara quaedam et immortalis in eo, si credimus, divinitas perhibetur Anaximandro Milesio physico, quem ferunt Lacedaemoniis praedixisse ut urbem ac tecta custodirent, instare enim motum terrae, et tum urbs tota eorum corrui et Taygeti montis magna pars ad formam puppis eminens abrupta cladem eam insuper ruina oppressit.² perhibetur et Pherecydi Pythagorae doctori alia coniectatio, sed et illa divina, haustu aquae e puteo praesensisse ac praedixisse civibus³ terrae motum.

192 quae si vera sunt, quantum a deo tandem videri possunt tales distare dum vivant? et haec quidem arbitrio cuiusque existimanda relinquuntur: ventos in causa esse non dubium reor; neque enim umquam

¹ *Hermolaus Barbarus*: nuntiate aut unitate *codd.*; numine *Mayhoff*, perversitate? *Campbell*.

² *Rackham*: pressit.

³ civibus *Mayhoff*: tibi aut ibi aut om. *codd.*

^a Saturn, Jupiter and Mars, cf. § 82.

^b I.e. are in conjunction with the sun, or agree with him in aspect, and particularly when they are distant from him one quarter of the heaven (*Brotier*).

gentle, senses clear, intellects fertile and able to grasp the whole of nature; and they also have governments, which the outer races never have possessed, any more than they have ever been subject to the central races, being quite detached and solitary on account of the savagery of the nature that broods over those regions.

LXXXI. The theory of the Babylonians deems *Earthquakes, their causes;* that even earthquakes and fissures in the ground are caused by the force of the stars that is the cause of all other phenomena, but only by that of those three stars^a to which they assign thunderbolts; and that they occur when these are travelling with the sun or are in agreement with him, and particularly about the quadratures of the world.^b On this subject a remarkable and immortal inspiration is attributed (if we can believe it) to the natural philosopher Anaximander of Miletus, who is said to have warned the Spartans to be careful of their city and buildings, because an earthquake was impending; and subsequently the whole of their city collapsed, and also a large part of Mount Taygetus projecting in the shape of a ship's stern broke off and crashing down on it added to the catastrophe. Also another conjecture is attributed to Pherecydes the teacher of Pythagoras, this also inspired: he is said to have foretold to his fellow-citizens an earthquake, of which he had obtained a premonition in drawing water from a well. Assuming the truth of these stories, how far pray can such men even in their lifetime be thought to differ from a god? And though these matters may be left to the estimation of individual judgment; I think it indubitable that their cause is to be attributed to the winds; for tremors of the earth never

intremiscunt terrae nisi sopito mari caeloque adeo tranquillo ut volatus avium non pendeant subtracto omni spiritu qui vehit, nec umquam nisi post ventos, condito scilicet in venas et cava eius occulta flatu. neque aliud est in terra tremor quam in nube tonitrum, nec hiatus aliud quam cum fulmen erumpit incluso spiritu luctante et ad libertatem exire nitente.

193 LXXXII. Varie itaque quatitur, et mira eduntur opera, alibi prostratis moenibus, alibi hiatu profundo haustis, alibi egestis molibus, alibi emissis amnibus, nonnumquam etiam ignibus calidisve fontibus, alibi averso fluminum cursu. praecedit vero comitaturque terribilis sonus, alias murmuri similis, alias mugitibus aut clamori humano armorumve pulsantium fragori, pro qualitate materiae excipientis formaque vel cavernarum vel cuniculi per quem meet, exilius grassante in angusto, eodem rauco in recurvis, resultante in duris, fervente in umidis, fluctuante in
194 stagnantibus, furente contra solida. itaque et sine motu saepe editur sonus. nec simplici modo quatitur nonnumquam,¹ sed tremit vibratque. hiatus vero alias remanet ostendens quae sorbuit, alias occultat ore compresso rursusque ita inducto solo ut nulla

¹ *Dellefsen*: unquam.

occur except when the sea is calm and the sky so still that birds are unable to soar because all the breath that carries them has been withdrawn; and never except after wind, doubtless because then the blast has been shut up in the veins and hidden hollows of the sky. And a trembling in the earth is not different from a thunderclap in a cloud, and a fissure is no different from when an imprisoned current of air by struggling and striving to go forth to freedom causes a flash of lightning to burst out.

LXXXII. Consequently earthquakes occur in a variety of ways, and cause remarkable consequences, in some places overthrowing walls, in others drawing them down into a gaping cleft, in others thrusting up masses of rock, in others sending out rivers and sometimes even fires or hot springs, in others diverting the course of rivers. They are however preceded or accompanied by a terrible sound, that sometimes resembles a rumble, sometimes the lowing of cattle or the shouts of human beings or the clash of weapons struck together, according to the nature of the material that receives the shock and the shape of the caverns or burrows through which it passes, proceeding with smaller volume in a narrow channel but with a harsh noise in channels that bend, echoing in hard channels, bubbling in damp ones, forming waves in stagnant ones, raging against solid ones. Accordingly even without any movement occurring a sound is sometimes emitted. And sometimes the earth is not shaken in a simple manner but trembles and vibrates. Also the gap sometimes remains open, showing the objects that it has sucked in, while sometimes it hides them by closing its mouth and drawing soil over it again in such a way as to

PLINY: NATURAL HISTORY

vestigia exstent: urbibus plerumque devoratis agrorumque tractu hausto, maritima autem maxime quatiuntur, nec montuosa tali malo carent: exploratum mihi est Alpes Appenninumque saepius tremuisse.

195 Et autumno ac vere terrae crebrius moventur, sicut fulmina. ideo Galliae et Aegyptus minime quatiuntur, quoniam hic aestatis causa obstat, illic hiemis. item noctu saepius quam interdiu. maximi autem motus existunt matutini vespertinique, sed propinqua luce crebri, interdiu autem circa meridiem. fiunt et solis lunaeque defectu, quoniam tempestates tunc sopiuntur, praecipue vero cum sequitur imbres aestus imbresve aestum.

196 LXXXIII. Navigantes quoque praesentiunt¹ non dubia coniectura sine flatu intumescente fluctu subito aut quatiante ictu. intremunt vero et in navibus postes aequae² quam in aedificiis crepituque praenuntiant; quin et volucres non inpavidae sedent. est et in caelo signum praeceditque motu futuro aut interdiu aut paulo post occasum sereno tenuis ceu linea nubes in longum porrecta spatium.

197 LXXXIV. Est et in puteis turbidior aqua nec sine odoris taedio, sicut in iisdem est remedium, quale et crebri specus praebent, conceptum enim spiritum

¹ *Rackham*: sentiunt.

² *Rueck*: positeque vel posita aequae.

BOOK II. LXXXII. 194-LXXXIV. 197

leave no traces; it being usually cities that are engulfed, and a tract of farmland swallowed, although seaboard districts are most subject to earthquakes, and also mountainous regions are not free from disaster of the kind: I have ascertained that tremors have somewhat frequently occurred in the Alps and Apennines.

Earthquakes are more frequent in autumn and spring, as is lightning. Consequently the Gallic provinces and Egypt suffer very little from them, as in the latter the summer is the cause that prevents them and in the former the winter. Similarly they are more frequent by night than in the daytime. The severest earthquakes occur in the morning and the evening, but they are frequent near dawn and in the daytime about noon. They also occur at an eclipse of the sun or moon, since then storms are lulled, but particularly when heat follows rain or rain heat.

LXXXIII. Sailors at sea can also anticipate an earthquake and forecast it with certainty when a sudden wave swells up without there being a wind, or a shock shakes the vessel. Even in ships posts begin to tremble just as they do in buildings, and foretell an earthquake by rattling; nay more, birds of timid kinds perch on the rigging. There is also a sign in the sky: when an earthquake is impending, either in the daytime or a little after sunset, in fine weather, it is preceded by a thin streak of cloud stretching over a wide space.

LXXXIV. Another sign is when the water in wells is muddier and has a somewhat foul smell, just as in wells there is also a remedy for earthquake such as frequently caves too afford, as they supply

exhalant. quod in totis notatur oppidis: minus quatiuntur crebris ad eluviem cuniculis cavata, multoque sunt tutiora in iisdem illis quae pendent, sicuti Neapoli in Italia intellegitur, parte eius quae solida est ad tales casus obnoxia. tutissimi sunt aedificiorum fornices, anguli quoque parietum postesque alterno pulsu renitentes; et latere terreno
 198 facti parietes minore noxa quatiuntur. magna differentia est et in ipso genere motus, pluribus siquidem modis quatitur; tutissimum est cum vibrat crispante aedificiorum crepitu et cum intumescit adsurgens alternoque motu residit; innoxium et cum concurrentia tecta contrario ictu arietant, quoniam alter motus alteri renitur. undantis inclinatio et fluctus more quaedam volutatio infesta est, aut cum in unam partem totus se motus impellit. desinunt autem tremores cum ventus emersit, sin vero duravere, non ante XL dies sistuntur, plerumque et tardius, utpote cum quidam annuo et bienni spatio duraverint.
 199 LXXXV. Factum est semel, quod equidem in Etruscae disciplinae voluminibus invenio, ingens terrarum portentum L. Marcio Sexto Iulio coss. in agro Mutinensi. namque montes duo inter se concurrerunt crepitu maximo adsultantes recedentesque, inter eos flamma fumoque in caelum exeunte interdium, spectante e via Aemilia magna equitum Romanorum familiarumque et viatorum multitudine. eo con-

* 91 B.C.

an outlet for the confined breath. This is noticed in whole towns: buildings pierced by frequent conduits for drainage are less shaken, and also among these the ones erected over vaults are much safer—as is noticed in Italy at Naples, the solidly built portion of the city being specially liable to collapses of this nature. The safest parts of buildings are arches, also angles of walls, and posts, which swing back into position with each alternate thrust; and walls built of clay bricks suffer less damage from being shaken. There is also a great difference in the actual kind of movement, as the earth shakes in *varieties of* several ways; there is least danger when it quivers with a trembling rattle of the buildings, and when it rises in a swell and settles back again, with an alternating motion; also no harm is done when buildings collide and ram against each other, as the one motion counteracts the other. A waving bend and a sort of billowy fluctuation is dangerous, or when the whole movement drives in one direction. Earthquakes stop when the wind has found an outlet, or else, if they go on, they do not stop before forty days, and usually even longer, some in fact having gone on for one or two years' time.

LXXXV. I find in the books of the lore of Tuscany *historical cases of* that once a vast and portentous earthquake occurred in the district of Modena; this was during the consulship^a of Lucius Marcius and Sextus Julius. Two mountains ran together with a mighty crash, leaping forward and then retiring with flames and smoke rising between them to the sky; this took place in the daytime, and was watched from the Aemilian road by a large crowd of Knights of Rome with their retinues and passers by. The shock

cursu villae omnes elisae, animalia permulta quae intra fuerant exanimata sunt, anno ante sociale bellum quod haud scio an funestius terrae ipsi Italiae fuerit quam bella civilia. non minus mirum ostentum et nostra cognovit aetas anno Neronis principis supremo, sicut in rebus eius exposuimus, pratis oleisque intercedente publica via in contrarias sedis transgressis in agro Marrucino, praediis Vetti Marcelli equitis Romani res Neronis procurantis.

200 LXXXVI. Fiunt simul cum terrae motu et inundationes maris eodem videlicet spiritu infusi aut terrae sidentis sinu recepti. maximus terrae memoria mortalium exstitit motus Tiberii Caesaris principatu, XII urbibus Asiae una nocte prostratis, creberrimus Punico bello intra eundem annum septies ac quinquagies nuntiatus Romam, quo quidem anno ad Trasimenum lacum dimicantes maximum motum nec Poeni sensere nec Romani. nec vero simplex malum aut in ipso tantum motu periculum est, sed par aut maius ostento¹: numquam urbs Roma tremuit ut non futuri eventus alicuius id praenuntium esset.

201 LXXXVII. Eadem nascentium causa terrarum est, cum idem ille spiritus adtollendo potens solo non valuit erumpere. nascuntur enim nec fluminum

¹ ?<in> ostento *Rackham*.

^a A.D. 68.

^b The neighbourhood of Teate, now Chieti, on the Adriatic coast.

^c 217 B.C.

^d Lago di Perugia.

brought down all the country houses, and a great many animals in the buildings were killed. It was in the year before the Allies' War, which was perhaps more disastrous to the land of Italy than the civil wars. Our generation also experienced a not less marvellous manifestation in the last year^a of the Emperor Nero, as we have set forth in our history of his principate: meadows and olive trees with a public road running between them got over to the opposite sides of the road; this took place in the Marrucian territory,^b on the lands of Vettius Marcellus, Knight of Rome, Nero's estate-manager.

LXXXVI. Earthquakes are accompanied by inundations of the sea, which is presumably caused to flood the land by the same current of air, or drawn into the bosom of the earth as it subsides. The greatest earthquake in human memory occurred when Tiberius Caesar was emperor, twelve Asiatic cities being overthrown in one night; the most numerous series of shocks was during the Punic War, when reports reached Rome of fifty-seven in a single year; it was the year^c when a violent earthquake occurring during an action between the Carthaginian and Roman armies at Lake Trasimene^d was not noticed by the combatants on either side. Nor yet is the disaster a simple one, nor does the danger consist only in the earthquake itself, but equally or more in the fact that it is a portent; the city of Rome was never shaken without this being a premonition of something about to happen.

LXXXVII. The cause of the birth of new lands⁽²⁾ is the same, when that same breath although powerful enough to cause an upheaval of the soil has not been able to force an exit. For lands are born not only

consequences
of:
(1) inundations;

(Earthquakes
portentous.)

(2) new
land formations.

tantum invectum (sicut Echinades insulae ab Acheloo amne congestae maiorque pars Aegypti a Nilo in quam a Pharo insula noctis et diei cursum fuisse Homero credimus) nec recessu maris, sicut idem Circeis, quod accidisse et in Ambraciae portu decem milium passuum intervallo et Atheniensium quinque milium ad Piraeum memoratur, et Ephesi ubi quondam aedem Dianae adluebat. Herodoto quidem si credimus, mare fuit supra Memphim usque ad Aethiopum montes itemque a planis Arabiae, mare circa Ilium et tota Teuthranie quaque campos intulerit Maeander.

202 LXXXVIII. Nascuntur et alio modo terrae ac repente in alio¹ mari emergunt velut paria secum faciente natura quaeque hauserit hiatus alio loco reddente.

LXXXIX. Clarae iam pridem insulae Delos et Rhodos memoriae produntur enatae, postea minores, ultra Melon Anaphe, inter Lemnum et Hellespontum Neae, inter Lebedum et Teon Halone, inter Cycladas Olympiadis CXLV anno quarto Thera et Therasia, inter easdem post annos CXXX Hiera, eademque Automate, et ab ea duobus stadiis post annos CX in nostro aevo M. Iunio Silano L. Balbo coss. a. d. VIII Idus Iulias Thia.

¹ *v.l.* aliquo.

* *Odyssey* IV. 354. ^b II. 10.
 • A legendary king in Mysia.
 • The river between Lydia and Caria.
 • 197 B.C. The figures in this passage are very uncertain.
 † A.D. 19.

through the conveyance of soil by streams (as the Echinades Islands when heaped up from the river Achelous and the greater part of Egypt from the Nile—the crossing from the island of Pharos to the coast, if we believe Homer,^a having formerly taken twenty-four hours) or by the retirement of the sea as once took place at Circei; such a retirement is also recorded to have occurred to a distance of 10,000 paces in the harbour of Ambracia, and to a distance of 5,000 at the Athenian port of Piraeus; and at Ephesus, where once the sea used to wash up to the temple of Diana. At all events if we believe Herodotus,^b there was sea above Memphis as far as the mountains of Ethiopia and also towards the plains of Arabia, and sea round Ilium, and over the whole territory of Teuthras^c and where the Maeander^d has spread prairie-land.

LXXXVIII. New lands are also formed in another way, and suddenly emerge in a different sea, nature as it were balancing accounts with herself and restoring in another place what an earthquake has engulfed. Other new land formations.

LXXXIX. The famous islands of Delos and Rhodes are recorded in history as having been born from the sea long ago, and subsequently smaller ones, Anaphe beyond Melos, Neae between Lemnos and the Dardanelles, Halone between Lebedos and Teos, Thera and Therasia among the Cyclades in the 4th year^e of the 145th Olympiad; also in the same group Hiera, which is the same as Automate, 130 years later; and 2 stades from Hiera, Thia 110 years later, in our age, on July 8 in the year^f of the consulship of Marcus Junius Silanus and Lucius Balbus. Emergence of islands.

- 203 Ante nos et iuxta Italiam inter Aeolias insulas, item iuxta Cretam emersit MMD passuum una cum calidis fontibus, altera Olympiadis CLXIII anno tertio in Tusco sinu, flagrans haec violento cum flatu: proditurque memoriae magna circa eam multitudine piscium fluitante confestim exspirasse quibus ex his cibus fuisset. sic et Pithecussas in Campano sinu ferunt ortas, mox in his montem Epopon, cum repente flamma ex eo emicuisset, campestri aequatum planitiei. in eadem et oppidum haustum profundo, alioque motu terrae stagnum emersisse, et alio provolutis montibus insulam exitisse Prochytam.
- 204 XC. Namque et hoc modo insulas rerum natura fecit: avellit Siciliam Italiae, Cyprum Syriae, Euboeam Boeotiae, Euboeae Atalanten et Macrian, Besbicum Bithyniae, Leucosiam Sirenum promunturio. XCI. Rursus abstulit insulas mari iunxitque terris, Antissam Lesbo, Zephyrium Halicarnasso, Aethusan Myndo, Dromiscon et Pernen Mileto, Narthecusam Parthenio promunturio. Hybanda quondam insula Ioniae ducentis nunc a mari abest stadiis, Syrien Ephesus in mediterraneo habet, Derasidas et Sapphoniā vicinā ei Magnesia. Epidaurus et Oricum insulae esse desierunt.
- 205 XCII. In totum abstulit terras primum omnium ubi Atlanticum mare est, si Platoni credimus,

* 126 B.C.

• *Timaeus* 24 E.

Before our time also among the Aeolian Islands near Italy, as well as near Crete, there emerged from the sea one island 2500 paces long, with hot springs, and another in the 3rd year^a of Olympiad 163 in the bay of Tuscany, this one burning with a violent blast of air; and it is recorded that a great quantity of fish were floating round it, and that people who ate of them immediately expired. So also the Monkey Islands are said to have risen in the bay of Campania, and later one among them, Mount Epopos, is said to have suddenly shot up a great flame and then to have been levelled with the surface of the plain. In the same plain also a town was sucked down into the depths, and another earthquake caused a swamp to emerge, and another overturned mountains and threw up the island of Procida.

XC. For another way also in which nature has made islands is when she tore Sicily away from Italy, Cyprus from Syria, Euboea from Boeotia, Atalantes and Macrias from Euboea, Besbicus from Bithynia, Leucosia from the Sirens' Cape. XCI. Again she has taken islands away from the sea and joined them to the land—Antissa to Lesbos, Zephyrius to Halicarnassus, Aethusa to Myndus, Dromiscos and Pernes to Miletus, Narthecusa to Cape Parthenius. Hybanda, once an Ionian island, is now 25 miles distant from the sea, Ephesus has Syrie as part of the mainland, and its neighbour Magnesia the Derasides and Sapphonia. Epidaurus and Oricum have ceased to be islands.

Detachment of islands from mainland.

XCII. Cases of land entirely stolen away by the sea are, first of all (if we accept Plato's story^b), the vast area covered by the Atlantic, and next, in the

Encroachment of sea.

inmenso spatio, mox interno quoque¹ quae videmus hodie, mersam Acarnaniam Ambracio sinu, Achaiam Corinthio, Europam Asiamque Propontide et Ponto. Ad hoc perrupit mare Leucada, Antirrhium, Hellespontum, Bosporos duos.

XCIII. Atque ut sinus et stagna praeteream, ipsa se comest terra. devoravit Cibotum altissimum montem cum oppido Cariae, Sipylum in Magnesia et prius in eodem loco clarissimam urbem quae Tantalus vocabatur, Galenes et Galames urbium in Phoenice agros cum ipsis, Phegium Aethiopiae iugum excelsissimum, tamquam non infida grassarentur et litora. XCIV. Pyrram et Antissam circa
206 Maeotim Pontus abstulit, Helicen et Buram sinus Corinthius, quarum in alto vestigia apparent. ex insula Cea amplius triginta milia passuum abrupta subito cum plurimis mortalibus rapuit, et in Sicilia dimidiam Tyndarida urbem ac quicquid ab Italia deest, similiter in Boeotia Eleusina.

XCIV. Motus enim terrae sileantur et quicquid est ubi saltem busta urbium exstant, simul² terrae miracula potius dicamus quam scelera naturae. et, Hercule, non caelestia enarratu difficiliora fuerint:
207 metallorum opulentia tam varia, tam dives, tam fecunda, tot saeculis suboriens, cum tantum cotidie orbe toto populentur ignes, ruinae, naufragia, bella,

¹ quoque *add. Mayhoff (om. quae).* ² *Rackham: simul ut.*

^a This long peninsula off the W. coast of Acarnania was made into an island by the Corinthians who in the 7th cent. B.C. cut a canal through the isthmus joining it with the mainland.

^b The Channel of Istambul and the Kertsch from the Black Sea to the Sea of Azov.

inland seas also, the areas that we see submerged at the present day, Acarnania covered by the Ambracian Gulf, Achaea by the Gulf of Corinth, Europe and Asia by the Sea of Marmora and the Black Sea. Also the sea has made the channels of Leucas,^a Antirrhium, the Dardanelles and the two Bospori.^b

XCIII. And to pass over bays and marshes, the earth is eaten up by herself. She has devoured the highest mountain in Caria, Cibotus, together with the town of that name, Sipylus in Magnesia, and previously the very celebrated city in the same place that used to be called Tantalus, the territories of Galene and Galame in Phoenicia with the cities themselves, and the loftiest mountain range in Ethiopia, Phegium—just as if the coasts also did not treacherously encroach! XCIV. The Black Sea has stolen Pyrra and Antissa in the neighbourhood of Lake Maeotis, the Gulf of Corinth Helice and Bura, traces of which are visible at the bottom of the water. The sea suddenly snatched away more than 30,000 paces together with most of the human beings from the Island of Ceos, and half the city of Tyndaris in Sicily, and all the gap in the coast of Italy, and similarly Eleusis in Boeotia.

XCIV. For let earthquakes not be mentioned, and every case where at least the tombs of cities survive, and at the same time let us tell of the marvels of the earth rather than the crimes of nature. And, I will swear, not even the heavenly phenomena could have been more difficult to recount: the wealth of mines so varied, so opulent, so prolific, brought to the surface in so many ages, although every day all over the world so much devastation is wrought by fires, collapse of buildings, shipwrecks, wars, frauds,

Collapse of mountains.

Products of earth: minerals, gems, emanations.

fraudes, tantum vero luxuria et tot mortales conterant, gemmarum pictura tam multiplex, lapidum tam discolores maculae, interque eos candor alicuius praeter lucem omnia excludens, medicatorum fontium vis, ignium tot locis emicantium perpetua tot saeculis incendia, spiritus letales aut ¹ scrobibus emissi aut ipso loci situ, mortiferi alibi volucris tantum, ut

208 Soracte vicino urbi tractu, alibi praeter hominem ceteris animantibus, nonnumquam et homini, ut in Sinuessano agro et Puteolano, quae spiracula vocant, alii Charonea, scrobes mortiferum spiritum exhalantes, item in Hirpinis Ampsancti ad Mephitis aedem locum quem qui intravere moriuntur, simili modo Hierapoli in Asia Matris tantum Magnae sacerdoti innoxium; alibi fatidici specus, quorum exhalatione temulenti futura praecinant, ut Delphis nobilissimo oraculo. Quibus in rebus quid possit aliud causae adferre mortalium quispiam quam diffusae per omne naturae subinde aliter atque aliter numen erumpens?

209 XCVI. Quaedam vero terrae ad ingressus tremunt, sicut in Gabiensi agro non procul urbe Roma iugera ferme ducenta equitantium cursu, similiter in Reatino. quaedam insulae semper fluctuantur, sicut in agro Caecubo et eodem Reatino, Mutinensi, Statoniensi, in Vadimonis lacu, ad Cutilias aquas

¹ *Rackham*: alibi aut.

* Phengitis, described XXXVI 163 as translucent but not transparent.

and so great is the consumption of luxury and of the multitudes of mankind; such a variety of patterned gems, such many-coloured markings in stones, and among them the brilliance of a certain stone ^a that only allows actual daylight to penetrate through it; the profusion of medicinal springs; the flames of fire flickering up in so many places, unceasing for so many centuries; the lethal breaths either emitted from chasms or due to the mere formation of the ground, in some places fatal only to birds, as in the region of Soracte near Rome, in others to all living creatures except man, and sometimes to man also, as in the territory of Sinuessa and of Pozzuoli—the places called breathing holes, or by other people jaws of hell—ditches that exhale a deadly breath; also the place near the Temple of Mephitis at Ampsanctus in the Hirpinian district, on entering which people die; likewise the hole at Hierapolis in Asia, harmless only to the priest of the Great Mother; elsewhere prophetic caves, those intoxicated by whose exhalations foretell the future, as at the very famous oracle at Delphi. In these matters what other explanation could any mortal man adduce save that they are caused by the divine power of that nature which is diffused throughout the universe, repeatedly bursting out in different ways?

XCVI. In some places, the earth trembles when trodden on—for instance in the Gabii district not far from the city of Rome about 200 acres shake when horsemen gallop over them, and similarly in the Reate district. Certain islands are always afloat, as in the districts of Caecubum and of Reate mentioned above and Modena and Statonium, and in Lake Vadimo, the dense wood near the springs of

Earth tremors.

Floating islands.

opaca silva quae numquam die ac nocte eodem loco visitur, in Lydia quae vocantur Calaminae non ventis solum sed etiam contis quo libeat impulsae, multorum civium Mithridatico bello salus. sunt et in Nymphaeo parvae, Saliare dictae, quoniam in symphoniae cantu ad ictus modulantium pedum moventur. in Tarquiniensi lacu magno Italiae duae nemora circumferunt, nunc triquetram figuram edentes nunc rotundam complexu ventis impellentibus, quadratam numquam.

- 210 XCVII. Celebre fanum habet Veneris Paphos, in cuius quandam aream non impluit, item in Nea, oppido Troadis, circa simulacrum Minervae, in eodem
211 et relictis sacrificia non putrescunt. XCVIII. iuxta Harpasa oppidum Asiae cautes stat horrenda uno digito mobilis, eadem, si toto corpore impellatur, resistens. in Taurorum paeninsula in civitate Parasino terra est qua sanantur omnia vulnera. at circa Asson Troadis lapis nascitur quo consumuntur omnia corpora; sarcophagus vocatur. duo sunt montes iuxta flumen Indum quorum¹ alteri natura ut ferrum omne teneat, alteri ut respuat; itaque si sint clavi in calciamento, vestigia avelli in altero non posse, in altero sisti. Locris et Crotone pestilentiam numquam fuisse nec ullo terrae motu laboratum adnotatum est, in Lycia vero semper a terrae motu quadraginta

¹ quorum *add. Rackham.*

* A promontory in Illyria.

Cutilia which is never to be seen in the same place by day and by night, the islands in Lydia named the Reed Islands which are not only driven by the winds, but can be punted in any direction at pleasure with poles, and so served to rescue a number of the citizens in the Mithridatic war. There are also small islands at Nymphaeum^a called the Dancing Islands, because they move to the foot-beats of persons keeping time with the chanting of a choral song. On the great lake of Tarquini in Italy two islands float about carrying woods, their outline as the winds drive them forward now forming the shape of a triangle and now of a circle, but never a square.

XCVII. Paphos possesses a famous shrine of Venus on a certain court in which rain does not fall, and the same in the case round an image of Minerva at the town of Nea in the Troad; in the same town also sacrifices left over do not go bad. XCVIII. Near the town of Harpasa in Asia stands a jagged rock that can be moved with one finger, but that also resists a push made with the whole body. On the peninsula of Tauri in the state of Parasinum there is some earth which heals all wounds. But in the neighbourhood of Assos in the Troad a stone is produced that causes all bodies to waste away; it is called the Flesh-eater. There are two mountains near the river Indus, the nature of one of which is to hold all iron and that of the other to reject it; consequently if a man has nails in his shoes, on one of the mountains at each step he is unable to tear his foot away from the ground and on the other he cannot set it down on the ground. It is recorded that at Locri and Croton there has never been a plague or earthquake, and that in Lycia an earth-

*Local earth
marvels.*

dies serenos esse. in agro Arpano frumentum satum non nascitur, ad aras Mucias in Veiente et apud Tusculanum et in silva Ciminia loca sunt in quibus in terram depacta non extrahuntur. in Crustumino natum faenum ibi noxium, extra salubre est.

- 212 XCIX. Et de aquarum natura complura dicta sunt. sed aestus maris accedere et reciprocare maxime mirum, pluribus quidem modis, verum causa in sole lunaque. bis inter duos exortus lunae adfluunt bisque remeant vicenis quaternisque semper horis, et primum attollente se cum ea mundo intumescentes, mox a meridiano caeli fastigio vergente in occasum residentes, rursusque ab occasu sub terra¹ ad caeli ima et meridiano contraria accedente inundantes, hinc donec iterum exoriatur se resorbentes;
- 213 nec umquam eodem tempore quo pridie reflui, velut² anhelantes³ sidere avido trahente secum haustu maria et adsidue aliunde quam pridie exoriente; paribus tamen intervallis reciproci senisque semper horis, non cuiusque diei aut noctis aut loci sed aequinoctialibus, ideoque inaequales vulgarium horarum spatio utcumque plures in eos aut diei aut noctis illarum mensurae cadunt, et aequinoctio tantum pares ubique. ingens argumentum plenumque lucis, ac vocis etiam diuinae, hebetes esse qui negent suptermeare sidera ac rursus eadem exurgere, similemque terris, immo vero naturae uni-

¹ *Detlefsen*: subter.

² *Rueck*: reflui ut.

³ *Mayhoff* (cf. *Mela* III 2): ancillantes.

* The Roman hour was a twelfth part of actual daytime or night-time, thus varying in length throughout the year; and only at the equinox was a diurnal hour equal to a nocturnal hour, an exact twenty-fourth of day and night.

quake is always followed by forty days' fine weather. Corn sown in the Arpi district does not come up, and at Mucian Altars in the district of Veii and at Tusculum and in the Ciminian Forest there are places where stakes driven into the ground cannot be pulled out. Hay grown in the Crustumium district is noxious on the spot but healthy when conveyed elsewhere.

XCIX. About the nature of bodies of water a *Tides, theory* great deal has been said. But the rise and fall of the tides of the sea is extremely mysterious, at all events in its irregularity; however the cause lies in the sun and moon. Between two risings of the moon there are two high and two low tides every 24 hours, the tide first swelling as the world moves upward with the moon, then falling as it slopes from the mid-day summit of the sky towards sunset, and again coming in as after sunset the world goes below the earth to the lowest parts of the heaven and approaches the regions opposite to the meridian, and from that point sucking back until it rises again; and never flowing back at the same time as the day before, just as if gasping for breath as the greedy star draws the seas with it at a draught and constantly rises from another point than the day before; yet returning at equal intervals and in every six hours, not of each day or night or place but equinoctial hours, so that the tidal periods are not equal by the space of ordinary hours whenever the tides occupy larger measures of either diurnal or nocturnal hours, and only equal everywhere at the equinox.^a It is a vast and illuminating proof, and one of even divine utterance, that those are dull of wit who deny that the same stars pass below the earth and rise up again, and that they present a similar appearance to the

versae, exinde¹ faciem in iisdem ortus occasusque operibus, non aliter sub terra manifesto sideris cursu aliove effectu quam cum praeter oculos nostros feratur.

215 Multiplex etiamnum lunaris differentia, primumque septenis diebus: quippe modici a nova ad dividuam aestus pleniore ab ea exundant plenaque maxime fervent; inde mitescunt, pares ad septimam primis, iterumque alio latere dividua augentur, in coitu solis pares plenae. eadem in² aquilonia et a terris longius recedente mitiores quam cum in austros digressa propiore nisu vim suam exercet. per octonos quosque annos ad principia motus et paria incrementa centesimo lunae revocantur ambitu. augent³ ea cuncta solis annuis causis, duobus aequinoctiis maxime tumentes et autumnali amplius quam verno, inanes vero
216 bruma et magis solstitio. nec tamen in ipsis quos dixi temporum articulis, sed paucis post diebus, sicuti neque in plena aut novissima sed postea, nec statim ut lunam mundus ostendat occultetve aut media plaga declinet verum fere duabus horis aequinoctialibus serius, tardiore semper ad terras omnium quae geruntur in caelo effectu cadente quam visu, sicuti fulguris et tonitrus et fulminum.

¹ *v.l.* et inde: ostendi? *Campbell.*

² *v.l.* om. in. ³ *Mayhoff*: augenta.

lands and indeed to the whole of nature in the same processes of rising and setting, the course or other operation of a star being manifest beneath the earth in just the same way as when it is travelling past our eyes.

Moreover, the lunar difference is manifold, and to begin with, its period is seven days: inasmuch as the tides, which are moderate from new moon to half-moon, therefrom rise higher and at full moon are at their maximum; after that they relax, at the seventh day being equal to what they were at first; and they increase again when the moon divides on the other side, at the union of the moon with the sun being equal to what they were at full moon. When the moon is northward and retiring further from the earth the tides are gentler than when she has swerved towards the south and exerts her force at a nearer angle. At every eighth year the tides are brought back at the hundredth circuit of the moon to the beginnings of their motion and to corresponding stages of increase. They make all these increases owing to the yearly influences of the sun, swelling most at the two equinoxes and more at the autumn than the spring one, but empty at midwinter and more so at midsummer. Nevertheless this does not occur at the exact points of time I have specified, but a few days after, just as it is not at full or new moon but afterwards, and not immediately when the world shows or hides the moon or slopes it in the middle quarter, but about two equinoctial hours later, the effect of all the occurrences in the sky reaching the earth more slowly than the sight of them, as is the case with lightning, thunder and thunder-bolts.

Tides and lunar periods.

- 217 Omnes autem aestus in oceano maiora integunt spatia nudantque quam in reliquo mari, sive quia motum universitate animosius quam parte est, sive quia magnitudo aperta sideris vim laxe grassantis efficacius sentit, eandem angustiis arcentibus, qua de causa nec lacus nec amnes similiter moventur. (octogenis cubitis supra Britanniam intumescere aestus Pytheas Massiliensis auctor est). et interiora
- 218 autem maria terris clauduntur ut in¹ portu; quibusdam tamen in locis spatiosior laxitas dicioni paret, utpote cum plura exempla sint in tranquillo mari nulloque velorum pulsu tertio die ex Italia pervektorum Uticam aestu fervente. circa litora autem magis quam in alto deprehenduntur hi motus, quoniam et in corpore extrema pulsum venarum, id est spiritus, magis sentiunt. in plerisque tamen aestuaris propter dispares siderum in quoque tractu exortus diversi existunt aestus tempore, non ratione, discordes, sicut in Syrtibus.
- 219 C. Et quorundam tamen privata natura est, velut Tauromenitani euripi saepius et in Euboea septies die ac nocte reciprocantis. idem aestus triduo in mense consistit, septima octava nonaque luna. Gadibus qui est delubro Herculis proximus fons inclusus ad putei modum alias simul cum oceano augetur minuiturque, alias utrumque contrariis temporibus; eodem in loco alter oceani motibus

¹ in *add. Mayhoff.*

^a I.e. the moon.

^b I.e. the Straits of Messina.

But all the tides cover and lay bare greater spaces in the ocean than in the rest of the sea, whether because it is more furious when moved in its entirety than when in part, or because the open extent feels the force of the star^a when it marches untrammelled with more effect, whereas narrow spaces hinder the force, which is the reason why neither lakes nor rivers have tides like the ocean (Pytheas of Marseilles states that north of Britain the tides rise 120 ft.) But also the more inland seas are shut in by land like the water in a harbour; yet a more untrammelled expanse is subject to the tidal sway, inasmuch as there are several instances of people making the crossing from Italy to Utica in two days in a calm sea and with no wind in the sails when a strong tide was running. But these motions are observed more round the coasts than in the deep sea, since in the body too the extremities are more sensitive to the pulse of the veins, that is of the breath. But in most estuaries owing to the different risings of the stars in each region the tides occur irregularly, varying in time though not in method, as for instance in the Syrtes.

C. And nevertheless some tides have a special nature, for instance the channel at Taormina^b that ebbs and flows more frequently, and the one at Euboea that has seven tides in twenty-four hours. The tide at Euboea stops three times a month, on the seventh, eighth and ninth day after the new moon. At Cadiz the spring nearest the shrine of Hercules, which is enclosed like a well, sometimes rises and sinks with the ocean and sometimes does both at the contrary periods; a second spring in the same place agrees with the motions of the ocean.

Ocean tides higher than those of inland seas.

Exceptional local tides.

consentit. in ripa Baetis oppidum est cuius putei crescente aestu minuuntur, augescunt decedente, mediis temporum immobiles. eadem natura Hispali in ipso oppido¹ uni puteo, ceteris vulgaris. et Pontus semper extra meat in Propontidem, introrsus in Pontum numquam refluo mari.

220 CI. Omnia pleno fluctu² maria purgantur, quaedam et stato tempore. circa Messanam et Mylas fimo similia expuuntur in litus purgamenta, unde fabula est Solis boves ibi stabulari. his addit (ut nihil quod equidem noverim praeteream) Aristoteles nullum animal nisi aestu recedente expirare. Observatum id multum in Gallico oceano et dumtaxat in homine compertum.

221 CII. Quo vera coniectatio existit haut frustra spiritus sidus lunam³ existimari, hoc esse quod terras saturet, accedensque corpora impleat, abscedens inaniat; ideo cum incremento eius augeri conchyliis, et maxime spiritum sentire quibus sanguis non sit, sed et sanguinem hominum etiam cum lumine eius augeri ac minui, frondes quoque ac pabula (ut suo loco dicetur) sentire, in omnia eadem penetrante vi.

222 CIII. Itaque solis ardore siccatur liquor, et hoc esse masculum sidus accepimus, torrens cuncta sorbensque; sic mari late patenti saporem incoqui salis, aut

¹ *Rackham*: Hispali (*v.ll.* in ipsote, in Hispali) oppido.

² *Mayhoff*: pleni unio.

³ spiritum sidus lunae *edd. vett.*

^a Or, emending the text, 'the moon's star is believed to be breath.'

^b XVIII. 321 ff.

There is a town on the banks of the Guadalquivir whose wells sink when the tide rises and rise when it falls, remaining stationary in the intervening periods. At Seville there is one well in the actual town that has the same nature, though all the others are as usual. The Black Sea always flows out into the Sea of Marmora—the tide never sets inward into the Black Sea.

CI. All seas excrete refuse at high tide, some *Tidal refuse.* also periodically. In the neighbourhood of Messina and Mylae scum resembling dung is spat out on to the shore, which is the origin of the story that this is the place where the Oxen of the Sun are stalled. To this (so that I may leave out nothing that is within my knowledge) Aristotle adds that no animal dies except when the tide is ebbing. This has been widely noticed in the Gallic Ocean, and has been found to hold good at all events in the case of man.

CII. This is the source of the true conjecture *Lunar influence.* that the moon is rightly believed to be the star of the breath,^a and that it is this star that saturates the earth and fills bodies by its approach and empties them by its departure; and that consequently shells increase in size as the moon waxes, and that its breath is specially felt by bloodless creatures, but also the blood even of human beings increases and diminishes with its light; and that also leaves and herbage (as will be stated in the proper place^b) are sensitive to it, the same force penetrating into all things.

CIII. Consequently liquid is dried by the heat *Effects of sunlight.* of the sun, and we are taught that this is the male star, which scorches and sucks up everything; and that in this way the flavour of salt is boiled into the

quia exhausto inde dulci tenuique, quod facillime trahat vis ignea, omne asperius crassiusque linquatur (ideo summa aequorum aqua dulciorem profundam,¹ hanc esse veriorem causam asperi saporis quam quod mare terrae sudor sit aeternus), aut quia plurimus ex arido misceatur illi vapor, aut quia terrae natura sicut medicatas aquas inficiat. est in exemplis Dionysio Siciliae tyranno, cum pulsus est ea potentia, accidisse prodigium ut uno die in portu dulcesceret mare.

223 CIV. E contrario ferunt lunae femineum ac molle sidus, atque nocturnum solvere umorem et trahere, non auferre. id manifestum esse quod ferarum occisa corpora in tabem visu suo resolvat, somnoque sopitis torporem contractum in caput revocet, glaciem refundat, cunctaque umifico spiritu laxet: ita pensari naturae vices semperque sufficere, aliis siderum elementa cogentibus, aliis vero fundentibus. sed in dulcibus aquis lunae alimentum esse sicut in marinis solis.

224 CV. Altissimum mare XV stadiorum Fabianus tradit. alii in Ponto ex adverso Coraxorum gentis (vocant *βαθέα* Ponti) trecentis fere a continenti stadiis immensam altitudinem maris tradunt, vadis

¹ *v.l.* summam . . . aquam . . . profunda.

wide expanse of the sea, either because the sweet and liquid, which is easily attracted by fiery force, is drawn out of it, but all the harsher and denser portion is left (this being why in a calm sea the water at a depth is sweeter than that at the top, this being the truer explanation of its harsh flavour, rather than because the sea is the ceaseless perspiration of the land), or because a great deal of warmth from the dry is mixed with it, or because the nature of the earth stains the waters as if they were drugged. One instance is that when Dionysius the tyrant of Sicily was expelled from that position, he encountered the portent that on one day the sea-water in the harbour became fresh water.

CIV. The moon on the contrary is said to be a *Effects of moonlight* feminine and soft star, and to disengage moisture at night and attract, not remove it. The proof given for this is that the moon by her aspect melts the bodies of wild animals that have been killed and causes them to putrefy, and that when people are fast asleep she recalls the torpor and collects it into the head, and thaws ice, and unstiffens everything with moistening breath: thus (it is said) nature's alternations are held in balance, and there is always a supply, some of the stars drawing the elements together while others scatter them. But the nutriment of the moon is stated to be contained in bodies of fresh water as that of the sun is in seawater.

CV. According to the account of Fabianus, the *Depth of seas.* deepest sea has a depth of nearly two miles. Others report an immense depth of water (called the Black Sea Deeps) off the coast of the Coraxi tribe on the Black Sea, about 37 miles from land, where soundings

numquam repertis. CVI. Mirabilius id faciunt aquae dulces iuxta mare ut fistulis emicantes. nam nec aquarum natura miraculis cessat. dulces mari invehuntur, leviores haut dubie. ideo et marinae, quarum natura gravior, magis invecta sustinent. quaedam vero et dulces inter se supermeant alias, ut in Fucino lacu invectus amnis,¹ in Lario Addua, in Verbanno Ticinus, in Benaco Mincius, in Sebino Ollius, in Lemanno Rhodanus, hic trans Alpes, superiores in Italia, multorum milium transitu hospitali suas tantum nec largiores quam intulere aquas evehentes. proditum hoc et in Oronte amne
 225 Syriae multisque aliis. quidam vero odio maris ipsa subeunt vada, sicut Arethusa, fons Syracusanus in quo redduntur iacta in Alpheum qui per Olympiam fluens Peloponnesiaco litori infunditur. subeunt terras rursusque redduntur Lycus in Asia, Erasinus in Argolica, Tigris in Mesopotamia; et quae in Aesculapi fonte Athenis mersa sunt in Phalerico redduntur. et in Atinate campo fluvius mersus post XX milia passuum exit, et in Aquileiensi Timavus.
 226 Nihil in Asphaltite Iudaeae lacu qui bitumen gignit mergi potest, nec in Armeniae maioris Aretissa; is quidem nitrosus pisces alit. in Salentino iuxta

¹ <Pitonius> amnis ex XXXI. 41 *Mayhoff*.

have never reached bottom. CVI. This is rendered more remarkable by springs of fresh water bubbling out as if from pipes on the seashore. In fact the nature of water also is not deficient in marvels. Patches of fresh water float on the surface of the sea, being doubtless lighter. Consequently also sea-water being of a heavier nature gives more support to objects floating upon it. But some fresh waters too float on the surface of others; cases are the river carried on the surface of Lake Fucino, the Adde on the Lake of Como, the Ticino on Maggiore, the Mincio on Garda, the Ollio on Lago d'Iseo, the Rhone on the Lake of Geneva (the last north of the Alps, but all the rest in Italy), after a passing visit that covers many miles carrying out their own waters only and no larger quantity than they introduced. This has also been stated in the case of the river Orontes in Syria and many others. But some rivers so hate the sea that they actually flow underneath the bottom of it, for instance the spring Arethusa at Syracuse, in which things emerge that have been thrown into the Alpheus which flows through Olympia and reaches the coast in the Peloponnese. Instances of rivers that flow under ground and come to the surface again are the Lycus in Asia, the Erasinus in the Argolid and the Tigris in Mesopotamia; and objects thrown into the Spring of Aesculapius at Athens are given back again in Phaleron Harbour. Also a river that goes underground in the Plain of Atinas comes out 20 miles further on, as also does the Timavus in the district of Aquileia. In Lake Asphaltis in Judaea, which produces bitumen, nothing can sink, and also in the Aretissa in Greater Armenia; the latter indeed is a nitrous lake that supports fish. A lake near the town

Remarkable properties of rivers.

oppidum Manduriam lacus ad margines plenus neque exhaustis aquis minuitur neque infusis augetur. in Ciconum flumine et in Piceno lacu Velino lignum deiectum lapideo cortice obducitur, et in Surio Colchidis flumine adeo ut lapidem plerumque durans adhuc integat cortex. Similiter in flumine Silero ultra Surrentum non virgulta modo immersa verum et folia lapidescunt, alias salubri potu eius aquae. in exitu paludis Reatinae saxum crescit et in rubro mari oleae virentesque frutices enascuntur.

- 227 Sed fontium plurimorum natura miro¹ est fervore, idque etiam in iugis Alpium, ipsoque in mari, ut inter Italiam et Aenariam in² Baiano sinu et in Liri fluvio multisque aliis. nam dulcis haustus in mari plurimis locis, ut ad Chelidonias insulas et Aradum et in Gaditano oceano. Patavinorum aquis calidis herbae virentes innascuntur, Pisanorum ranae, ad Vetulonios in Etruria non procul a mari pisces. In Casinate fluvius appellatur Scatebra, frigidus, abundantior aestate; in eo ut in Arcadiae³ Stymphali nascuntur aquatiles muscoli. in Dodone Iovis fons cum sit gelidus et immersas faces extinguat, si extinctae admoveantur accendit. idem meridie semper deficit, qua de causa ἀναπνόμενον vocant; mox increscens ad medium noctis exuberat, ab eo rursus sensim deficit. in Illyricis supra fontem frigidum expansae

¹ Rackham: mira. ² Mayhoff: ut in aut et in.
³ v.l. Arcadia.

^a In Thrace.

^b In the Sabine region from which the people of Picenum originally came, cf. III xviii.

^c I.e. the petrified bark remains the surface of the log.

of Manduria in the Salentine district is full to the brim, and is not reduced when water is drawn out of it nor increased when water is poured into it. In the river of the Cicones^a and in the Veline Lake of Picenum,^b wood thrown into the water gets covered with a film of stone, and in the river Surius in Colchis this goes so far that the stone in most cases is covered with bark still lasting.^c Similarly in the Sele beyond Sorrento not only twigs but also leaves immersed in the river become petrified, though apart from this its water is healthy to drink. Rock forms in the outlet of the marsh at Rieti, and olive trees and green bushes grow in the Red Sea.

But the nature of a great many springs is of remarkably high temperature, and this is found even on the ridges of the Alps, and actually in the sea, for instance in the Gulf of Baiae between Italy and the Island of Ischia, and in the river Garigliano and many others. In fact fresh water may be drawn from the sea in a great many places, as at the Swallow Islands and at Aradus and in the Gulf of Cadiz. Green grass grows in the hot springs of Padua, frogs in those of Pisa, fishes at Vetulonia in Tuscany near the sea. A river in the district of Casino called the Bubbling Water is cold, and is fuller in summer; water voles are born in it, as they are in the Stymphalis of Arcadia. The Fountain of Jupiter at Dodona, though it is cold and puts out torches dipped in it, sets them alight if they are brought near to it when they are out. The same spring always stops flowing at noon, on account of which it is called the Wait-a-bit; later it rises again and towards midnight flows abundantly, thereafter gradually ceasing again. A cold spring in Illyria sets fire to clothes spread out

Remarkable springs.

- vestis accenduntur. Iovis Hammonis stagnum interdiu frigidum noctibus fervet. in Trogydytis fons Solis appellatur dulcis et circa meridiem maxime frigidus; mox paulatim tepescens ad noctis media
- 229 fervore et amaritudine infestatur. Padi fons mediis diebus aestivis velut interquiescens semper aret. in Tenedo insula fons semper a tertia noctis hora in sextam ab aestivo solstitio exundat, et in Delo insula Inopus fons eodem quo Nilus modo ac pariter cum eo decrescit augeturve. contra Timavom amnem insula parva in mari est cum fontibus calidis, qui pariter cum aestu maris crescunt minuunturque. in agro Pitinate trans Appenninum fluvius Novanus
- 230 omnibus solstitiis torrens bruma siccatur. in Falisco omnis aqua pota candidos boves facit. in Boeotia amnis Melas oves nigras, Cephisus ex eodem lacu profluens albas, rursus nigras Peneus, rufasque iuxta Ilium Xanthus, unde et nomen amni. in Ponto fluvius Astaces inrigat campos in quibus pastae nigro lacte equae gentem alunt. in Reatino fons Neminie appellatus alio atque alio loco exoritur annonae mutationem significans. Brundisi in portu fons incorruptas semper¹ praestat aquas navigantibus. Lyncestis aqua quae vocatur acidula vini modo temulentos facit; item in Paphlagonia et in agro Caleno.
- 231 Andro in insula, templo Liberi patris, fontem nonis Ianuariis semper vini sapore fluere² Mucianus

¹ Brotier: in spira (aut om.) codd.

² v.l. saporem fundere.

* In Campania.

above it. The swamp of Jupiter Ammon is cold by day and hot at night. A spring in the Cave-dwellers' territory called the Fountain of the Sun is sweet and very cold at midday, but then gradually warming, towards the middle of the night it becomes spoilt owing to its heat and bitter taste. The source of the Po always dries up at midday in summer as if taking a siesta. A spring on the Island of Tenedos after midsummer always overflows from 9 to 12 p.m.; and the spring Inopus on the island of Delos sinks or rises in the same way as the Nile and at the same times. On a small island in the sea at the mouth of the river Timavus there are hot springs that grow larger and smaller with the rise and fall of the tide. In the Pitino district across the Apennines the river Novanus is always hot at midsummer and dried up at midwinter. In the district of Falerii all the water makes oxen that drink it white. The Blackwater in Boeotia makes sheep black, the Cephisus flowing from the same lake makes them white, the Peneus again makes them black, and the river Xanthus at Ilium red, which gives the river its name. Mares pastured on the plains watered by the river Astaces on the Black Sea suckle their foals with black milk. The spring called Neminie in the district of Reate rises now in one place and now in another, indicating a change in the price of corn. A spring in the harbour at Brindisi always supplies pure water for mariners. The slightly acid spring called Lyncestis makes men tipsy, like wine; the same occurs in Paphlagonia and in the territory of Cales.^a

It is accredited by the Mucianus who was three times consul that the water flowing from a spring in the temple of Father Liber on the island of

ter consul credit; dies¹ Θεοδοσία vocatur. iuxta Nonacrim in Arcadia Styx nec odore differens nec colore epota ilico necat; item in Liberoso Taurorum colle tres fontes sine remedio, sine dolore mortiferi. in Carrinensi Hispaniae agro duo fontes iuxta fluunt, alter omnia respuens, alter absorbens; in eadem gente alius aurei coloris omnes ostendit pisces, nihil extra
 232 illam aquam differentes. in Comensi iuxta Larium lacum fons largus horis singulis semper intumescit ac residit. in Cydonea insula ante Lesbum fons calidus vere tantum fluit. lacus Sannaus in Asia circa nascente absinthio inficitur. Colophone in Apollinis Clari specu lacuna est cuius potu mira redduntur oracula, bibentium brevior vita. amnes retro fluere et nostra vidit aetas Neronis principis supremis, sicut in rebus eius retulimus.

233 Iam omnes fontes aestate quam hieme gelidiores esse quem fallit? sicut illa permira naturae opera: aes ac plumbum in massa mergi, dilatatum fluitare, eiusdemque ponderis alia sidere alia invehit; onera in aqua facilius moveri; Scyrium lapidem quamvis grandem innatare, eundemque comminutum mergi; recentia cadavera ad vadum labi, intumescencia attolli; inania vasa haud facilius quam plena ex-

¹ v.l. Διός.

Andros always has the flavour of wine on January 5th: the day is called God's Gift Day. To drink of the Styx near Nonacris in Arcady causes death on the spot, although the river is not peculiar in smell or colour; similarly three springs on Mount Liberosus in Taurica irremediably but painlessly cause death. In the territory of Carrina in Spain there are two adjacent springs of which one rejects all objects and the other sucks them down; another in the same nation makes all the fish in it look of a golden colour, although except when in that water there is nothing peculiar about them. In the district by the Lake of Como a copious spring always swells up and sinks back again every hour. A hot spring on the island of Cydonea off Lesbos flows only in the springtime. Lake Sannaus in Asia is dyed by the wormwood springing up round it. In the cave of Apollo of Claros at Colophon there is a pool a draught from which causes marvellous oracular utterances to be produced, though the life of the drinkers is shortened. Even our generation has seen rivers flow backward at Nero's last moments, as we have recorded in our history of that Emperor.

Again everybody is aware that all springs are colder in summer than in winter, as well as of the following miracles of nature: that bronze and lead sink when in mass form, but float when flattened out into sheets; that among objects of the same weight some float and others sink; that heavy bodies are more easily moved in water; that stone from Scyros in however large a mass floats, and the same stone broken into small pieces sinks; that bodies recently dead sink to the bottom but rise when they begin to swell; that empty vessels cannot be drawn out of

Universal properties of springs.

trahi; pluvias salinis aquas utiliores esse quam reliquas, nec fieri salem nisi admixtis dulcibus; 234 marinas tardius gelare, celerius accendi; hieme mare calidius esse, autumnale salsius; omne oleo tranquilari, et ob id urinantes ore spargere quoniam mitiget naturam asperam lucemque deportet; nives in alto mari non cadere; cum omnis aqua deorsum feratur, exilire fontes, atque etiam in Aetnae radicibus, flagrantis in tantum ut quinquagena, centena milia passuum harenas flammaram globo eructet. CVII. 235 (Namque et ignium, quod est naturae quartum elementum, reddamus aliqua miracula, sed primum ex aquis.)

CVIII. In urbe Commagenes Samosata stagnum est emittens limum (maltham vocant) flagrantem cum quid attigit solidi, adhaeret; praeterea tactus et sequitur fugientes. sic defendere muros oppugnante Lucullo, flagrabatque miles armis suis. aquis etiam accenditur; terra tantum restingui docuere experimenta.

CIX. Similis est natura naphthae: ita appellatur circa Babylonem et in Astacenis Parthiae profluens bituminis liquidi modo. hic magna cognatio ignium, transiliuntque in eam protinus undecumque visam. ita fertur a Medea paelicem crematam, postquam sacrificatura ad aras accesserat, corona igne rapto.

^a On the W. bank of the Euphrates.

^b In the Mithradatic War, 74 B.C.

the water more easily than full ones; that rain water is more useful than other water for salt-works, and that fresh water has to be mixed with sea water for the salt to be deposited; that sea water freezes more slowly, and boils more quickly; that the sea is warmer in winter and salter in autumn; that all sea water is made smooth by oil, and so divers sprinkle oil from their mouth because it calms the rough element and carries light down with them; that on the high sea no snow falls; that though all water travels downward, springs leap upwards, and springs rise even at the roots of Etna, which is so hot that it belches out sands in a ball of flame over a space of 50 to 100 miles at a time. CVII. (For we must also report some marvels connected with fire, the fourth element of nature, but first those arising from water.)

CVIII. In Samosata the capital of Commagene ^a *Mineral pitch.* there is a marsh that produces an inflammable mud called mineral pitch. When this touches anything solid it sticks to it; also when people touch it, it actually follows them as they try to get away from it. By these means they defended the city walls when attacked ^b by Lucullus: the troops kept getting burnt by their own weapons. Water merely makes it burn more fiercely; experiments have shown that it can only be put out by earth.

CIX. Naphtha is of a similar nature—this is the *Naphtha.* name of a substance that flows out like liquid bitumen in the neighbourhood of Babylon and the parts of Parthia near Astacus. Naphtha has a close affinity with fire, which leaps to it at once when it sees it in any direction. This is how Medea in the legend burnt her rival, whose wreath caught fire after she had gone up to the altar to offer sacrifice.

- 236 CX. Verum in montium miraculis ardet Aetna noctibus semper, tantoque aevo materiam¹ ignium sufficit, nivalis hibernis temporibus egestumque cinerem pruinis operiens. nec illo tantum natura saevit exustionem terris denuntians. flagrat in Phaselitis mons Chimaera, et quidem immortalibus diebus ac noctibus flamma. ignem eius accendi aqua, extingui vero terra aut fimo² Cnidius Ctesias tradit. eadem in Lycia Hephaesti montes taeda flammante tacti flagrant, adeo ut lapides quoque rivorum et harenae in ipsis aquis ardeant, aliturque ignis ille pluviis. baculo si quis ex his accenso traxerit
- 237 sulcum, rivos ignium sequi narrant. flagrat in Bactris Cophanti noctibus vertex, flagrat in Medis et in Sittacene,³ confinio Persidis, Susis quidem ad Turrim Albam quindecim caminis, maximo eorum et interdiu. campus Babyloniae flagrat e⁴ quadam veluti piscina iugeri magnitudine; item Aethiopum iuxta Hesperium montem stellarum modo campi noctu nitent. similiter in Megalopolitanorum agro, nam si intermisit ille iucundus frondemque densi supra se nemoris non adurens et iuxta gelidum fontem semper ardens Nymphaei crater, dira Apolloniatis suis portendit, ut Theopompus tradidit. augetur imbribus egeritque bitumen temperandum fonte illo ingustabili, et alias omni bitumine dilutius. sed
- 238 quis haec miretur? in medio mari Hiera et Lipara⁵

¹ Rackham: materia.

² Mayhoff: faeno.

³ in Cissia gente (cf. *Hdt.* 6. 119) *Detlefsen*.

⁴ e add. *Mayhoff*.

⁵ et Lipara add. *Mayhoff coll. Strab.* VI. p. 277.

^a In Lycia.

^b Now Afghan Turkestan.

CX. But among mountain marvels—Etna always ^{Volcanic} glows at night, and supplies its fires with fuel sufficient ^{mountains.} for a vast period, though in winter cloaked with snow and covering its output of ashes with hoar frost. Nor does nature's wrath employ Mount Etna only to threaten the lands with conflagration. Mount Chimaera in the country of Phaselis^a is on fire, and indeed burns with a flame that does not die by day or night; Ctesias of Cnidos states that water increases its fire but earth or dung puts it out. Also the Mountains of Hephaestus in Lycia flare up when touched with a flaming torch, and so violently that even the stones of the rivers and the sands actually under water glow; and rain only serves to feed this fire. They say that if somebody lights a stick at it and draws a furrow with the stick, streams of fire follow it. At Cophantium in Bactria^b a coil of flame blazes in the night, and the same in Media and in Sittacene the frontier of Persia: indeed at the White Tower at Susa it does so from fifteen smoke-holes, from the largest in the daytime also. The Babylonian Plain sends a blaze out of a sort of fishpool an acre in extent; also near Mount Hesperius in Ethiopia the plains shine at night like stars. Likewise in the territory of Megalopolis: for if that agreeable Bowl of Nymphaeus, which does not scorch the foliage of the thick wood above it and though near a cold stream is always glowing hot, ceases to flow, it portends horrors to its neighbours in the town of Apollonia, as Theopompus has recorded. It is augmented by rain, and sends forth asphalt to mingle with that unappetizing stream, which even without this is more liquid than ordinary asphalt. But who would be surprised by these things? During

insulae Aeoliae iuxta Italiam cum ipso mari arsere¹ per aliquot dies sociali bello, donec legatio senatus piavit. maximo tamen ardet incendio Theon Ochema dictum Aethiopum iugum, torrentesque solis ardoribus flammam egerit.

Tot locis, tot incendiis rerum natura terras cremat.
 239 CXI. Praeterea cum sit huius unius elementi ratio fecunda, seque ipsa pariat et minimis crescat a scintillis, quid fore putandum est in tot rogis terrae? quae est illa natura quae voracitatem in toto mundo avidissimam sine damno sui pascit? addantur his sidera innumera ingensque sol, addantur humani ignes et lapidum quoque insiti naturae attritique inter se ligni, iam nubium et origines fulminum: excedet profecto miracula omnia ullum diem fuisse quo non cuncta conflagrarent, cum specula quoque concava adversa solis radiis facilius etiam accendant
 240 quam ullus alius ignis. quid quod innumerabiles parvi sed naturales scatent? in Nymphaeo exit e petra flamma quae pluviis accenditur; exit et ad aquas Scantias, haec quidem invalida, cum transit, nec longe in alia durans materia: viret aeterno hunc fontem igneum contegens fraxinus; exit in Mutinensi agro stans Volcano diebus. reperitur apud auctores

¹ *v.l.* insula Aeolia . . . arsit.

^a Probably Mount Kakulima in West Africa (not Ethiopia) is referred to.

^b Or possibly 'concave lenses.'

^c In Latium. ^d In Campania.

^e The Feast of Vulcan in August.

the Allies' War Holy Island and Lipari among the Aeolian Islands near Italy burnt in mid sea for several days, as did the sea itself, till a deputation from the senate performed a propitiatory ceremony. Nevertheless the largest volcanic blaze is that of the ridge in Ethiopia called the Gods' Carriage,^a which discharges flames that glow with truly solar heat.

In so many places and by so many fires does nature burn the countries of the earth.

CXI. Moreover, as this one element has a fertile *Marvels of fire.* principle that engenders itself and grows out of the smallest sparks, what must be expected to happen in future among all these funeral pyres of the earth? What is the natural principle that pastures a most voracious appetite on the whole world while itself unimpaired? Add thereto the innumerable stars and the mighty sun, add the fires of man's making and also those implanted in the nature of stone and of timber rubbing against itself, and again the fire of clouds, and the sources of thunderbolts—and doubtless all marvels will be surpassed by the fact that there has ever been a single day on which there has not been a universal conflagration, when also hollow mirrors^b facing the sun's rays set things alight more easily than any other fire. What of the countless small but natural eruptions of fire? In the river Nymphaeus^c a flame comes out of a rock that is kindled by rain; also one comes out at the Scantian Springs,^d not a strong one, it is true, as it passes away, and not lasting long on any substance which it touches—an ash tree shading this fiery spring is everlastingly green; one comes out in the district of Modena on the days appointed as sacred to Vulcan.^e It is found in the authorities that in the fields lying

subiectis Ariciae arvis si carbo deciderit, ardere terram, in agro Sabino et Sidicino unctum flagrare lapidem, in Sallentino oppido Egnatia inposito ligno in saxum quoddam ibi sacrum protinus flammam existere, in Lacinae Iunonis ara sub diu sita cinerem
 241 immobilem esse perflantibus undique procellis; quin et repentinos existere ignes et in aquis et in corporibus, etiam humanis: Trasimenum lacum arsisse totum, Servio Tullio dormienti in pueritia ex capite flammam emicuisse, L. Marcio in Hispania interemptis Scipionibus contionanti et milites ad ultionem exhortanti arsisse simili modo Valerius Antias narrat. plura mox et distinctius; nunc enim quadam mixtura rerum omnium exhibentur miracula. verum egressa mens interpretationem naturae festinat legentium animos per totum orbem veluti manu ducere.

242 CXII. Pars nostra terrarum, de qua memoro, ambienti (ut dictum est) oceano velut innatans longissime ab ortu ad occasum patet, hoc est ab India ad Herculi¹ columnas Gadibus sacratas [LXXXV] LXVIII p., ut Artemidoro auctori placet, ut vero Isidoro, [XCVIII] XVIII. Artemidorus adicit amplius a Gadibus circuitu sacri promunturii ad promunturium Artabrum, quo longissime frons
 243 procurrat Hispaniae, DCCCXCD. Mensura currit duplici via: a Gange amne ostioque eius quo se in Eoum oceanum effundit per Indiam Parthyenenque

¹ *Rackham*: Hercules.

^a In Campania.

^b In the S.E. point of Italy.

^c Capo della Colonna.

^d They fell in battle with the Carthaginians 212 B.C.

under Arezzo if charcoal is dropped on the ground, the earth is set on fire; that in the Sabine and Sidicine district ^a a stone flames up when oiled; that in the Sallentine town of Egnatia, ^b if wood is put on a certain sacred rock, a flame at once shoots up; that ashes on the altar of Juno at Lacinium, ^c which stands in the open air, remains motionless when stormy winds sweep over it in every direction. Moreover, it is recorded that sudden fires arise both in pools of water and in bodies, even human bodies: Valerius Antias tells that the whole of Lake Trasimene once was on fire; that when Servius Tullius was a boy a flame flashed out from his head while he was asleep; and that a similar flame burnt on Lucius Marcius in Spain when he was making a speech after the death of the Scipios ^d and exhorting the soldiers to revenge. Later we shall give more instances, and more in detail; for at the present we are displaying a sort of medley of marvels of all the elements. But leaving the interpretation of nature our mind hastens to lead the reader's attention by the hand on a tour of the whole world.

CXII. Our own portion of the earth, which is my subject, swims as it were in the ocean by which, as we have said, it is surrounded; its longest extent is from East to West, *i.e.* from India to the Pillars consecrated to Hercules at Cadiz, a distance of 8,568 miles according to Artemidorus, but 9,818 according to Isidore. Artemidorus adds in addition from Cadiz round Cape St. Vincent to Cape Finisterre the longest projection of the coast of Spain, 890½ miles. The measurement runs by a double route; from the river Ganges and its mouth where it flows into the Eastern Ocean, through India and Parthyene to the

Dimensions of the inhabited earth from East to West,

ad Myriandrum urbem Syriae in Issico sinu positam [LII] XV, inde proxima navigatione Cyprum insulam, Patara Lyciae, Rhodum, Astypalaeam in Carpathio mari insulam, Taenarum Laconicae, Lilybaeum Siciliae, Caralim Sardiniae [XXI] III, deinde Gades [XII] L, quae mensura universa ab Eoo mari efficit 244 [LXXXV] LXVIII. alia via, quae certior, itinere terreno maxime patet a Gange ad Euphraten amnem [LI] LXIX, inde Cappadociae Mazaca CCXLIV, inde per Phrygiam et ¹ Cariam Ephesum CCCXCIX, ab Epheso per Aegeum pelagus Delum CC, Isthmum CCXII·D, inde terra et Alcyonio mari et Corinthiaco sinu Patras Peloponnesi CII·D, Leucadem LXXXVII·D, Corcyram totidem, Acroceraunia CXXXII·D, Brundisium LXXXVII·D, Romam CCCLX, trans ² Alpes usque ad Scingomagum vicum DXVIII, per Galliam ad Pyrenaeos montes Illiberim CCCCLVI, ad oceanum et Hispaniae oram DCCCXXXII, traiectu Gades VII·D, quae mensura Artemidori ratione [LXXXIX] XCV efficit. 245 Latitudo autem terrae a meridiano situ ad septentriones dimidio fere minor ab Isidoro ³ colligitur, [LIV] LXII, quo palam fit quantum et hinc vapor abstulerit et illinc rigor. neque enim id ⁴ deesse terris arbitror aut non esse globi formam, sed inhabitabilia utrimque inconperta esse. haec mensura currit a litore Aethiopici oceani, qua modo habitatur, ad Meroen DCCV, inde Alexandriam [XII] L, Rhodum DLXXXIV, Cnidum LXXXVI·D, Coum

¹ et add. Rackham.

² trans add. Rackham.

Syrian city of Myriandrus situated on the Gulf of Scanderoon 5,215, from there by the shortest sea-route to the Island of Cyprus, from Patara in Lycia to Rhodes, to the island of Astypalaea in the Carpathian Sea, to Taenarus in Laconia, Lilybaeum in Sicily, Caralis in Sardinia, 213, thence to Cadiz 1,250, the total distance from the Eastern Sea making 8,568. Another route, which is more certain, extends mainly overland from the Ganges to the river Euphrates 5,169, thence to Mazaca in Cappadocia 244, thence through Phrygia and Caria to Ephesus 499, from Ephesus across the Aegean Sea to Delos 200, to the Isthmus 202½, thence by land and the Alcyonian Sea and the Gulf of Corinth to Patras in the Peloponnese 102½, to Leucas 87½, to Corfu ditto, to Acroceraunia 82½, to Brindisi 87½, to Rome 360, across the Alps to the village of Suze 518, through France to the Pyrenees at Granada 456, to the Ocean and the coast of Spain 832, across to Cadiz 7½—which figures by Artemidorus's calculation make 8,995 miles.

But the breadth of the earth from the south point to the north is calculated by Isidorus as less by about one half, 5,462 miles, showing how much the heat has abstracted on one side and the cold on the other. As a matter of fact I do not think that there is this reduction in the earth, or that it is not the shape of a globe, but that the uninhabitable parts on either side have not been explored. This measurement runs from the coast of the Ethiopic Ocean, where habitation just begins, to Meroe 705 miles, thence to Alexandria, 1,250, Rhodes 584, Cnidus 86½, Cos 25,

and from North to South.

³ Mayhoff (ab add. Rackham): fere minore.

⁴ id add. Rackham.

XXV, Samum C, Chium XCIV, Mytilenen LXV, Tenedum XLIX, Sigeum promunturium XII·D, os Ponti CCCXII·D, Carambin promunturium CCCL, os Maeotis CCCXII·D, ostium Tanais CCLXVI, qui cursus compendiis maris brevior fieri potest. [XXI] X ab ostio Tanais Nili Canopicum¹ diligentissimi auctores fecere. Artemidorus ulteriora inconperta existimavit, cum circa Tanain Sarmatarum gentes degere fateretur ad septentriones versus. Isidorus adiecit [XII] L usque ad Thylen, quae coniectura divinationis est. ego non minore quam proxime dicto spatio Sarmatarum fines nosci intellego. et alioqui quantum esse debet quod innumerabiles gentes subinde sedem mutantem capiat? unde ulteriorem mensuram inhabitabilis plagae multo esse maiorem arbitror; nam et a Germania immensas insulas non pridem conpertas cognitum habeo.

247 De longitudine ac latitudine haec sunt quae digna memoratu putem. universum autem circuitum Eratosthenes (in omnium quidem litterarum subtilitate set² in hac utique praeter ceteros solers, quem cunctis probari video) CCLII milium stadiorum prodidit, quae mensura Romana computatione efficit trecentiens quindecimens centena milia passuum, improbum ausum, verum ita subtili argumentatione comprehensum ut pudeat non credere. Hipparchus

¹ Sic *Dellefsen*: potest LXXIX. ab ostio Tanais nihil modicum (immodicum *Mayhoff*).

² *Mayhoff*: et.

Samos 100, Chios 94, Mitylene 65, Tenedos 49, Cape Sigeum 12½, Bosphorus 312½, Cape Carambis 350, mouth of Lake Maeotis 312½, mouth of the Don 266,—a route that by cutting down the crossings can be shortened. From the mouth of the Don to the Canopic mouth of the Nile the most careful authorities have made the distance 2,110 miles. Artemidorus thought that the regions beyond had not been explored, though admitting that the tribes of the Sarmatae dwell round the Don to the northward. Isidorus added 1,250 miles right on to Thule, which is a purely conjectural estimate. I understand that the territory of the Sarmatae is known to an extent not less than the limit just stated. And from another aspect, how large is the space bound to be that is large enough to hold innumerable races that are continually migrating? This makes me think that there is an uninhabitable region beyond of much wider extent; for I am informed that beyond Germany also there are vast islands that were discovered not long ago.

These are the facts that I consider worth recording in regard to the earth's length and breadth. Its total circumference was given by Eratosthenes (an expert in every refinement of learning, but on this point assuredly an outstanding authority—I notice that he is universally accepted) as 252,000 stades, a measurement that by Roman reckoning makes 31,500 miles—an audacious venture, but achieved by such subtle reasoning that one is ashamed to be sceptical.^a Hipparchus, who in his refutation of

Dimension of circumference.

^a Modern authorities say that, whatever his result, the method of Eratosthenes was sound. See Heath, *Greek Astronomy*, pp. 109 ff.

et in coarguendo eo et in reliqua omni diligentia mirus, adicit stadiorum paulo minus XXVI.

248 Alia Dionysodoro fides (neque enim subtraham exemplum vanitatis Graecae maximum). Melius hic fuit geometricae scientia nobilis; senecta diem obiit in patria, funus duxere ei propinquae ad quas pertinebat hereditas. hae cum secutis diebus iusta peragerent, invenisse dicuntur in sepulcro epistulam Dionysodori nomine ad superos scriptam: pervenisse eum a sepulcro ad infimam terram, esse eam stadiorum XLII. Nēc defuere geometrae qui interpretarentur significare epistulam a medio terrarum orbe missam quod deorsum ab summo longissimum esset spatium et idem pilae medium. ex quo consecuta computatio est circuitum esse CCLII stadiorum pronuntiarentur.

CXIII. Harmonica ratio, quae cogit rerum naturam sibi ipsam congruere, addit huic rationi stadiorum XII, terramque XCVI partem totius mundi facit.

• I.e. $6 \times 42,000$, the length of the radius, taking π as 3.

Eratosthenes and also in all the rest of his researches is remarkable, adds a little less than 26,000 stades.

Dionysodorus (for I will not withhold this outstanding instance of Greek folly) has a different creed. He belonged to Melos, and was a celebrated geometrician; his old age came to its term in his native place; his female relations who were his heirs escorted his obsequies. It is said that while these women on the following days were carrying out the due rites they found in the tomb a letter signed with his name and addressed to those on earth, which stated that he had passed from his tomb to the bottom of the earth and that it was a distance of 42,000 stades. Geometricians were forthcoming who construed this to mean that the letter had been sent from the centre of the earth's globe, which was the longest space downward from the surface and was also the centre of the sphere. From this the calculation followed that led them to pronounce the circumference of the globe to be 252,000^a stades.

CXIII. To this measurement the principle of uniformity, which leads to the conclusion that the nature of things is self-consistent, adds 12,000 stades, making the earth the $\frac{1}{8}$ th part of the whole world.

C. Plinius Secundus.

PLINY

NATURAL HISTORY,

WITH AN ENGLISH TRANSLATION
IN TEN VOLUMES

VOLUME I

PRAEFATIO, LIBRI I, II

BY

H. RACKHAM, M.A.

FELLOW OF CHRIST'S COLLEGE, CAMBRIDGE



CAMBRIDGE, MASSACHUSETTS
HARVARD UNIVERSITY PRESS

LONDON
WILLIAM HEINEMANN LTD

MCMLVIII